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I have listed *potential* references of interest in the opening section of these search results. *However, please be sure to review the entire report*. There may be additional references that you find useful.

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I. Potential References of Interest

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FINDING PERCEPTUALLY SIMILAR MUSIC WITH PRECOMPUTATION
RECHERCHE PAR CALCULS PRELIMINAIRES D'UNE MUSIQUE IDENTIQUE EN PERCEPTION

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English Abstract:

...a model of alikeness (105) which is based upon empirical observations of human perception of likeness between pairs of songs. The humans judge a representative **sample** of music (101) to build the model (105). Then other musical recordings (109) are applied to this system which extracts **parameters** (104) from the content of each recording and applies them to the model (105) to compute the differences between the **parameters** of the new recording and **parameters** developed for the model to place them in a data base of **parameter** differences (107). By allowing a user to select one of the recordings from the data base for which **parameters** have already been extracted, the system can efficiently work with a large number of recordings. A further efficiency improvement is achieved by precomputing differences between...

Detailed Description:

...the PCT Gazette.

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FINDING PERCEPTUALLY SIMILAR MUSIC WITH PRECOMPUTATION
11.0113ACKGROUND
Modern computers have made possible the efficient assemblage and
searching of large databases of information. Text-based information can be searched for key words. Until recently... ...metadata associated with each recording rather than via the acoustical content of the music itself. The metadata includes information such as title, artist, duration, publisher, **classification** applied by publisher or others ("**genre**"), instrumentation, and recording methods. For several reasons, it is highly desirable to be able to search the content of the music to find music which... ...a particular song and want to find another that is similar. A second reason is that textual metadata tends to put music into classes or **genres**, and a search in one **genre** can limit the discovery of songs from other **genres** that may be attractive to a listener. Often the **genre** label is applied at the artist or album level, and this label may be inappropriate at the song level. Yet another reason is that searching... ...music allows searches when textual information is absent, inaccurate, or inconsistent.

A company called Muscle Fish LLC in Berkeley, California has developed
computer methods for **classification**, search and retrieval of all kinds of sound
recordings. These methods are based on computationally extracting many
c Lparameters" from each sound recording to develop a **vector**, containing a large number of data points, which **characteristically** describes or represents the sound.

These methods are described in a paper entitled **Classification**, Search, and Retrieval of Audio by Erling Wold, Thom Blum, Douglas Keislar, and James Wheaton
which is was published in September 1999 on the Muscle... ...Method and article of manufacture for content-based analysis, storage, retrieval, and
segmentation of audio information."
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In the Blum system, a large number of **vectors**, each representing a brief
sound recording, is assembled in a data base. A user can **specify** ranges for each of the **parameters** to find within the data base a desired sound. Alternatively, the user can present to the system a new sound recording. The system then computes **parameters** for the recording, assembles the **parameters** into a **vector**, and then, by **vector** subtraction, computes the distance from the example sound recording to the previously stored sound recordings and presents to the user the sound recordings whose **vectors** are closest. Using this "query by example" method, a user can present a new sound to the data base and find other sounds within the data base that are similar.

2.0 SUMMARY OF THE INVENTION
The invention builds on the Blum method of extracting many **parameters** from each of many sound recordings and assembling them into a database. Like Blum, to build a database of sounds, a set of **parameters** is extracted from a large number of recordings. **Vectors** of the **parameters** (or

"descriptors" derived from the **parameters** as **specified** in US patent application number 09/556,086 which is incorporated by reference) are assembled and compared by subtraction or by finding the correlation.

The... ...and allow humans to find desired musical recordings within a large database of musical recordings.

To perform "query by example", instead of receiving a new **sample** of sound and performing all of the necessary computations of **parameters** and **vector** differences, the system allows a user to select one of the sounds already within the data base as the query starting point. By starting with a sound already in the database, the **parameters** have already been computed, the **vector** has already been assembled, and the distances to other **vectors** have already been computed. This precomputation allows the improved system to operate much more quickly than the Blum system. With this improvement, the system becomes ... ...find, within a very large database of music, music which is similar to music they already know. Also, by using a recording for which the **parameters** have already been extracted, copies of the system can be distributed without including **parameter** extraction methods that should not be made available. Similar benefits are obtained if the system also includes precomputed **vector** comparisons so that **vector** difference computation methods can be kept confidential.

In one embodiment of the invention, a business entity performs computation of **parameters** for all musical recordings to which it can gain access and then widely
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distributes these **parameters**, with identifiers **specifying** the recordings, to large numbers of people and computer systems throughout the world. By precomputing and widely distributing the **parameters**, others throughout the world will have the **parameters** to work with and will not need to compute the **parameters** themselves, and it provides a standardized computation of **parameters** to make them comparable from one recording to another. Others can then assemble sets of musical recording identifiers for which the **parameters** are available and use these selected sets to **specify** a search domain for finding music that is similar to a target musical recording where the **parameters** were also precomuted by the same original process. This will 1 0 allow the creativity of large numbers of people to be applied to selecting...first computation is made with one representative song from each cluster. In essence, the data base is "partitioned" into manageable sizes for computing differences between **vectors**.

As a further improvement, instead of simply computing simple **vector**
differences, the computation is adjusted with weightings to reflect a model of how humans perceive likeness between pairs of songs. One or more humans listen... ...10 matches per song and so some techniques for choosing those 1 0 matches is needed. The methods described use filters derived from the extracted **parameters**, combined with meta data from other sources.

3.0 BRIEF DESCRIPTION OF THE DRAWINGS
Figure 1 illustrates how the current invention is used to find music that humans perceive as sounding alike using weighted **parameters**.

Figure 2 illustrates how the current invention is used to find music that humans perceive as sounding alike using weighted descriptors.

Figure 3 illustrates a... ...illustrates a method for creating and searching a database.

Figure 5 is an example of an interface used to interact with a database.

4.0 **DETAILED** DESCRIPTION
4.1 Modeling likeness with **parameters** (Figure 1)
The invention is illustrated in Figure 1. A database of stored music 101 is played in pairs to one or more humans, step 102, who rate the music on likeness. In the preferred method, the same music is fed into a **parameter** extractor 103, that uses methods known in the art to extract **parameters** 104 that are relevant to the perception of music, such as tempo, rhythm complexity, rhythm strength, dynamic range, and harmonicity. Numerous different methods for extracting each of these **parameters** are known in the art. The model is refined, step 108, by minimizing the difference, calculated in step 106, between the human-derived likeness values and the model-derived values.

An alternative method uses humans to extract **parameters** that are relevant to the perception of music, such as tempo, rhythm complexity, rhythm strength, singer contribution, number of instruments, **type** of instruments, and voice timbre. This replaces the machine **parameter** extractor 103. The model is refined, step 108, by minimizing the difference, calculated in step 106, between the human-derived likeness values and the model... ...techniques known in the art.

4 2 Creating the likeness model
The objective of the model is to predict these perceived differences using the extracted **parameters** of music. To build the model, a list of numbers is calculated for the comparison of each song to each other song. The list of numbers consists of a value for each **parameter** where the value is the difference between the **parameter** value for a first song and the value of the same **parameter** for a second song. When the model is used to compare one song to another for likeness, the list of **parameter** differences between the two songs is calculated and these differences are the inputs to the model. The model then yields a number that predicts the... ...127
P4= 015
P5 = 223
P6 = 122
1 5 P7 = 074
Another method for deriving likeness is to calculate the correlation coefficients (r) of the **parameter** values between each pair of songs in the database, and to create a matrix of similarity for the songs, with high correlation equating to high similarity. The **parameter** values are normalized to ensure that they all have the same range. Song 1 provides the **parameters** for the x values, and song 2 provides the **parameters** for the y values in the following formula.

r = EN - Xmean) (Yi - Ymean) / Ay, (xi - Xmean)2][E (yi
Ymean)2]1
Where xmean and Ymean are the means of the normalized **parameter** values for songs 1 and 2.

The rationale behind using correlation coefficients is that if the **parameters** of two songs have a high positive correlation which is statistically significant then the two songs will be judged to be alike.

Yet another method... ...deriving likeness is to use a neural net to develop the model of likeness 105. In

this method, a portion of the human data and **parameter** data are used to train a network and another portion of the data are used to test the network. One such embodiment, using the neural net toolbox in Matlab TMJS described below in steps 1 to 7.

STEP 1) Construct a **vector** of **parameter** differences and correlations.

Call this IoaMat
STEP 2) Normalize the first 69 entries (the difference entries) using the mean
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(NormlMeans) and standard deviation (NormlStds) in NormlStats.mat
NormlloaMat = (loaMat(1:69)-NormlMeans)./NormlStds;
STEP 3) Divide **parameters** into classes. The indices corresponding to the
classes of different **parameter** classes for the **vector** in step 2 are defined by the following.

Class(l) = [1:14 72:92]; % **Parameter** 1
Class(2) = [18:19 70]; % **Parameter** 2
Class(3) = [71]; % **Parameter** 3
Class{4) = [19:26]; % **Parameter** 4
Class(5) = [67:69]; % **Parameter** 5
STEP 4) Apply Normalization and results from Principle Components Analysis (PCA).

a) Normalize each **vector** created in step 3 using the mean (Norm2Means)
and standard deviations (Norm2Stds) in NormMats.mat. Norm2Means and
Norm2Stds are U5 cell arrays, where each cell corresponds to each of the 5 **parameter** Classes. Thus, normalize each **parameter** class by its respective mean and std **vectors**.

for i=1:5
Norm2loaMatClass(i) = (NormlloaMat(Class(i)
Norm2Means{i)).Norm2Stds(i);
end
b) To apply the PCA, multiply each of the **parameter** Class **vectors** created in step 4a by the corresponding matrix in the PCAMats (1x5) cell array. (i.e.,
NewClassl = PCAMats{l)*OldClassl)
for i=1:5
PCAloaMatClass(i) = PCAMats(i)*Norm2loaMatClass(i);
end
c) Concatenate Classes into a single **vector**
NetinputVect
for i=1:5
NetlnputVect [NetinputVect; PCAloaMatClass{i)];
end
STEP 5) Take the log of some of the **parameters**. A number of the
transformed **parameters** in NetinputVect were found to be distributed
asymmetrically (i.e. Skewed), so take the log. After taking the log, normalize
according to Norm2lVleans and Norm3Stds... ...in
ClassPoints.mat. To get the class of a particular song pair, simply compute the euclidian distance

between NetlnputVect and each of the 2 74xl **vectors** in ClassPoints and choose the class associated with the smallest distance.

Distl = dist(NetinputVectClassPoints(:,l));
Dist2 = dist(NetlnputVectClassPoints(:,2));
if Distl<DIST2
Class=l;
else... ...of the two distance classes. To implement the network, do the
following
SimNetworkWeights.mat contains the two network objects: netl net2 as well
as the **parameters** of the output transformNLParameters
load SimNetworkWeights.mat
Choose the Network
if Class==l
net = net1l;
else
net = net2;
end
Compute Input Layer Activations
for i... ...exp(-(p(l)*Distance Ap(6) + p(2))));
FinalDistance = p(3)*temp.Ap(5) + p(4);
A fourth method of deriving likeness it to use **genre**- **specific** filtering. In this method, it is acknowledged that people may judge two songs as being more or less similar depending on whether or not the songs belong to the same **genre**. For example, two songs may have very similar **parameters**, but one may have subtle differences in instrumentation or **style** that puts it into the **genre** "country" whereas the other is in the **genre** " **rock**." Because the **parameters** of the songs differ only slightly, a general purpose model may judge them to be similar. However the perceived similarity is low.

To account for this, the songs are identified as belonging to one or more **genres** and a **genre** compatibility matrix is used to determine which **genres** can be presented as matches to other **genres**. The **genre** compatibility matrix is derived by asking people to rate the compatibility of pairs of **genres**, or by a Song Domain Expert. The songs are placed into **genres** using a combination of the **genre** information imposed by the song vendor, and by the clustering techniques described below.

A fifth method of deriving likeness acknowledges the context-dependence of likeness comparisons by creating **genre-specific** models of likeness. For example, if a person listens to a Jazz song, a Punk song, a **Classical** song, and a Death **Metal** song, the Punk song and the Death **Metal** song may be judged to sound alike.

However the same two songs may be judged as being dissimilar if the Punk song is
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presented only with other Death **Metal** songs. The steps for creating a **genre-specific** model are the same as for creating a general purpose model, except that the pairs of songs, 101 given to human listeners, 102, are from the same **genre**. The songs are placed into **genres** using a combination of the **genre** information imposed by the song vendor, and by the clustering techniques described below.

4 3 Building the likeness data
The preferred method of storing and organizing the **parameter** differences data is as a multi dimensional **vector** in a multi dimensional database 107. The resulting matrix contains n*(n-l)/2 cells where n is the number of songs. The model is used by starting with a target song 109, calculating the difference in value for each **parameter** between the comparison song and the songs in the database, steps 103 - 105, and then applying the model to the difference values to arrive at...a less accurate model.

(3) How well the subset represents the set. The ability to create a model depends on the existence of patterns of **parameters** in similar songs. If the subset on which the model is based does not represent the patterns that are present in the set, then the... ...using the model to predict what sounds alike by.

(a) Only applying the technique to music which has low intra-song variability (e.g. some **Classical** music has high variability within songs).

(b) Using statistical sampling techniques known in the art (for example, for political polling) to ensure that the subset... ...2 illustrates an alternative method for finding music that sounds to human listeners like any musical composition selected by a user. Instead of using the **parameters** directly, they are processed as described in US patent application number 09/556,086 by the same inventors to create a set of descriptors 206. These are used to create a model of likeness 207 by a process similar to that used to create the model of likeness using **parameters** 105.

4 1 Collecting human data
One or more humans listen to pairs of songs and judge their similarity on a scale, for example from...P4 = 6.3
P5 = 1 5.94
4 3 Organizing and storing the likeness data
The preferred and alternative methods of organizing and storing the **parameter** differences data for calculating likeness are also used when the process uses descriptors. In addition, there is yet another alternative for calculating likeness. It involves... ...n is the number of descriptors. In this case, 59049 classes. The songs in each class have the identical descriptor values.

This provides an alternative **type** of likeness.

Computing the database
The number of combinations of songs increases with the square of the number of songs.

For large numbers of songs this creates computational challenges because of.

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(a) The amount of data that must be read from the database of **parameters** 104,
(b) The number of comparisons that have to be performed, step 105, and
(c) The amount of data that must be written to the database of **parameter** differences, 107.

Methods for dealing with these challenges are described below.

4 1 Precornputing Partitions in the Database to Decrease the Number of

Comparisons (Figure...the set of all objects fits into exactly one cluster, and any one cluster contains one or more objects.

A PISA, or Partition Intrinsic Subjective **Attribute** is a measure of how well a song fits into a category of songs. The steps for creating a PISA are as follows.

Step 1... ...following criteria.

Partitions are distinct from one another -- i.e. sufficiently far from one another in similarity space for the SDE to recognize them as **genres**.

4' All songs within the partition sound mostly alike. (by "mostly" we mean with less than a 5% false positive error rate).

Partitions are generalizable...sampling process to select 256 songs.

Step 2: Use a self organizing neural net to arrange the songs into clusters on the basis of their **parameter** values.

Step 3: The clustering results are reviewed by a song domain expert (SDE) who defines legitimate clusters by listening to the songs.

Step 4... ...improves performance.

The preferred method for decreasing the amount of data read from the database is to decrease the amount of information contained within the **parameters** by decreasing the precision of the numeric values.

Another method loads all of the **parameter** data and the likeness models into RAM and then calculates and stores all of the likeness values without further recourse to the database. Selected likeness... ...which is based on the methods using descriptors shown in Figure 2. A large set of music 401, representing "all music" is sent to the **parameter** extractor 402. The descriptors are derived and then combined with other meta data and pointers to the location of the music, for ...405, and receive the results of that interrogation using an interface 406.

An example of an interface is illustrated in Figure 5. A user can **type** in textual queries using the text box 504. For example; "Song title: Samba pa ti, Artist.

Santana." The user then submits the query by pressing... ...The song "Samba pa ti" becomes the target song, and appears in the target box 501. The computer searches the n dimensional database 405 of **vectors** made up of the song descriptors, looking for the smallest **vector** distances between the target song and other songs. These songs are arranged in a hit list box 502, arranged in increasing **vector** distance (decreasing similarity). An indication of the **vector** distance between each hit song and the target song is shown beside each hit song, expressed as a percent, with 100% being the same song. For example, the
top of the list may be "Girl from lpanema by Stan Getz, 85%."

Another **type** of query allows a user to arrange the songs by profile. First, the user presses the sort by number button 509 which lists all of... ...target box 501 and lists songs in the hit box 503 that have the closest values to the values of the target song.

Yet another **type** of query allows the user to sort by similarity plus profile. First a target song is chosen and the songs in the hit box 502...Filtering Likeness to Improve Performance
The perceived performance of the database can be enhanced by filtering the results of likeness searches.

The preferred method uses **genres** and allows a user to instruct the system to return search results from the same, or different **genres** than the target song. The **genres** are derived from a combination of the clustering methods described earlier, or from information imposed by vendors.

A second method uses meta data for individual... ...to construct song "parents." A song parent is a grouping of songs with some common elements. For example, the songs of an artist, album or **genre** may have some common elements and are parents of individual
1 6
songs. The preferred method of constructing parents is to use a grouping algorithm... ...volume, listening activity, and search activity.

A fourth method uses user preference to create a taste template. A taste template describes the ranges of the **parameter** values for a set of songs that a user likes. The taste template can be used to filter the output of the likeness model to... ...tastes. The taste templates can also be compared across multiple users using collaborative filtering. The result of collaborative filtering uncovers taste preferences between people and **parameters**. For example, people who like songs with meta data or descriptors x, y, z also like songs with meta data or descriptors u,v,w...have good likeness matches. More explicitly, Neighborhood density is a weighted measure of how many songs appear as matches to a target song within a **specified** likeness distance. An example of the use of neighborhood density is when a user searches the database for songs in the **genre** L 9soundtrack" with the **mood** "**aggressive** ." The songs that are returned can be chosen by a number of criteria, including alphabetical order of title, most recently recorded, and neighborhood density. The... ...songs within a database that are like a target song. In the most generic implementation, a user can load a database of songs, compute the **parameters** for the songs, input a target song, compute the **parameters** for the target, and compute the likeness between the target and each song in the database using the system's model of likeness based on human perception of similarity. However, for a database of any substantial size, the computation of **parameters** for the target song and computation of likeness to other songs in the database requires so much time and processor dedication as to be impractical for large scale implementation.

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Part of the solution to this efficiency problem, as described above, is to precompute the **parameters** for each song in the database. Another part of the solution, as described above, is to precompute leader songs or partitions between songs in the database. With these precomputations, if the user provides a target song, the only computation remaining is to compute **parameters** for the target and compute comparisons to the partitions in the database. However, additional speed enhancements are required to make the system practical.

The final... ...allow the user to 1 0 input a recording of a song that is not already in the database. This

means that the computation of **parameters** for the target song has already been done and the computation of comparisons to other songs or partitions in the database has already been done...

Claims:

...using said precomputed set of likeness measures.

2 The method of claim 1 where the set of precomputed measures of likeness are generated by extracting **parameters** from each musical recording and computing comparisons between **parameters** for pairs of musical recordings.

3 The method of claim 1 where the method used to compute likeness measures between musical recordings was empirically developed ... ...readable data containing a computer program which causes one or more computers to perform the method of claim 4.

9 A method for using precomputed **parameters** for musical recordings to allow users to find similar musical recordings, comprising:a) for each of a plurality of musical recordings, computing a plurality of1 9 **parameters** extracted from the contents of each musical recording;b) receiving from a user a **specification** of a target musical recording for which **parameters** were precomputed and a **specification** of a set of other musicalrecordings for which **parameters** were precomputed; andC) using said precomputed **parameters**, computing likeness measures between said **specified** target musical recording and said **specified** set of other musicalrecordings; andd) presenting to the user a **specification** of one or more musical recordings from the **specified** set of other musical recordings having relatively high computed likeness measures to the **specified** target recording.The method of claim 9 where the method used to compute likeness measuresbetween musical recordings was empirically developed based on perceptions reported...human perception of likenessbetween musical recordings, comprising:a) extracting from each of at least 5 electronic representations of musicalrecordings at least two numeric **parameters**;b) receiving from one or more human listeners who compare pairs of the musicalrecordings an indication of the human's perception of likeness for eachcompared pair of recordings;C) for each compared pair of the recordings, comparing each numeric **parameter** of one recording in the pair with the corresponding **parameter** of the secondrecording in the pair using an algorithm which produces a **parameter**comparison number;20d) for each compared pair of the recordings, combining the **parameter** comparison numbers with a weighting for each **parameter** comparisonnumber to compute a single difference number representing the differencebetween the two recordings of the pair;e) adjusting the weightings for the comparison... ...reported for the pair ofrecordings by the one or more human listeners.

16 The method of claim 15 where the algorithm includes subtraction of **parameter** values.

17 The method of claim 15 where the algorithm includes computing a correlation between **parameter** values.

18 The method of claim 15 where the algorithm employs a neural network.

19 The method of claim 15 where, prior to the step of comparing the numeric **parameters**:a) the **parameters** for each recording are combined with a weighting for each**parameter** to

compute a single number representing a descriptor for thatrecording, whereb) the weightings were previously determined by adjusting the weightings to find a... ...perceptions reported for the recording by one or more humanlisteners, andC) the descriptors are then used in the step of comparing the numeric**parameters** in place of the **parameters**.
20 Computer readable data containing a computer program which causes one or more computers to perform the method of claim 15.

21 Computer readable data each musical recording of the set of musical recordings and the additional musical recordings at least two numeric **parameters**;C) associating an identifier with each recording of the set of musical recordingsand the additional musical recordings;d) assembling the identifiers for the set of musical recordings into a database; e) computing from the extracted **parameters** for each of a plurality of pairs of the recordings associated with each identifier in the database a number whichrepresents the difference between the... ...The method of claim 25 where computation of the number representing the difference between the recordings of the pair is done based on distribution of **parameter** values.
28 The method of claim 25 further comprising, within each partition, selecting one or more representative musical recordings to represent the partition and placing identifiers for additional musical recordings into partitions by comparing **parameters** for the recording associated with the identifier to **parameters** for the one or more representative musical recordings.

29 The method of claim 28 where the comparison step includes subtraction of 22**parameter** values.
30 The method of claim 28 where the comparison step includes computing a correlation between **parameter** values.

31 Computer readable data containing a computer program which causes one or more computers to perform the method of claim 25.

32 Computer readable... ...data record is associated, where each descriptor was generated by:1 extracting from an electronic representation of the recording ofmusical at least two numeric **parameters**;2) combining the numeric **parameters** with a weighting for each**parameter** to ...weightings were previously determined by:3) extracting from an electronic representation of each of at least 5musical recordings the same at least two numeric **parameters**;4) for each recording, combining the numeric **parameters** with aweighting for each **parameter** to compute a single number23representing the descriptor for that recording;5) adjusting the weightings for the **parameters** to find a set of weightingswhere each computed descriptor for each recording most closelymatches perceptions reported for the recording by one or more... ...with descriptors that are similar to the descriptors of the comparison record.
38 The method of claim 37 further including, prior to searching the database, **specifying** that one of the descriptors of the comparison data record should be adjusted with an increase or a decrease, and the searching step is based on the descriptors of the comparison data record as adjusted.

39 The method of claim 37 where the weightings for the **parameters** are adjusted using a neural network.

40 Computer readable data containing a computer program which causes one or more computers to

perform the method of...

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A system and method for querying a music database
System und Verfahren zum Abfragen einer Musikdatenbank
Systeme et methode d'interrogation d'une base de donnees musicale

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Abstract ...pieces of music, where the query (104) is performed by forming a database request consisting of a conditional expression relating to the name and/or **attributes** of the desired piece of music. Associated **parameters** are derived from the database query, and compared with corresponding **parameters** for the other pieces of music in the database (302). A desired piece of music is determined by searching for a minimum distance between the database query **parameters** and those associated with the pieces of music in the database (302).

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Specification: ...The present invention relates to the field of music systems and, in particular, to the identification and retrieval of particular pieces of music or alternately, **attributes** of a desired piece of

music, from a music database on the basis of a query composed of desired **features** and conditional statements. BACKGROUND OF THE INVENTION

Retrieval of music or music **attributes** from a database requires, in common with generic database functionality, a query method which is powerful and flexible, and preferably intuitively meaningful to the user... ...to systematic search and sort procedures. This latter aspect in turn requires that pieces of music be characterised in a manner which permits of such **classification**.

Thus a hierarchy of requirements or elements which make up a music database system are as follows:

* characterising music using **attributes** useful in a **classification** scheme

* classifying music in a meaningful searchable structure, and

* querying the database so formed, to yield meaningful results.

The hierarchy, has been defined "bottom up... ...a more meaningful progression by which the invention can be described.

When considering audio signals in general, and in particular those relating to music, the **nature** of the signals may be considered in **terms** of various **attributes** which are intuitively meaningful. These **attributes** include, among others, tempo, loudness, pitch and timbre. Timbre can be considered to be made up of a number of constituent sub-**features** including "sharpness" and "percussivity". These **features** can be extracted from music and are useful in characterising the music for a **classification** scheme.

The publication entitled "Using Bandpass and Comb Filters to Beat-track Digital Audio" by Eric D. Scheirer (MIT Media Laboratory, December 20, 1996) discloses... ...desktop workstation or alternately, a multi-processor architecture may be utilised. This method suffers from the disadvantage of being highly computationally intensive.

Percussivity is that **attribute** which relates to a family of musical instruments known as "percussion" when considering an orchestra or a band. This family includes such musical instruments as drums, cymbals, castanets and others. Processing of audio signals in general and musical signals in particular, benefits from the ability to estimate various **attributes** of the signals, and the present invention is concerned with estimating the **attribute** of percussivity.

A number of different methods have been used to estimate percussivity of a given signal, such methods including those broadly based upon:

* Short-time power analysis

* statistical analysis of signal amplitude

* comparison of harmonic **spectral** component power with total **spectral** power

Short-time signal power estimation involves calculation of an equivalent power (or an approximation thereof) within a short segment or "window" of a signal... ...The power estimate can be compared to a threshold in order to determine whether the portion of the signal within the window is percussive in **nature**. Alternatively, the power estimate can be compared to a sliding scale of thresholds, and the percussive content of the signal classified with reference to the... ...in a neighborhood in order to determine whether signal variations in the running mean are sufficiently large to signify that the signal is percussive.

Harmonic **spectral** component power analysis involves taking a windowed Fourier transform of the signal in question over the time period of interest, and then examining the resulting set of **spectral** components. The **spectral** components which are indicative of harmonic series are removed. It is noted that such harmonic series components typically represent local maxima in the overall **spectral** envelope of the signal. After removing the harmonic series **spectral** components, remaining **spectral** components substantially consist only of the inharmonic components of the signal, these being considered to represent percussive components of the signal. The total power in... ...all components, harmonic and non-harmonic, to yield an indication of percussivity.

The aforementioned analysis methods are typically intended to identify a range of signal **attributes**, and thus suffer from relatively limited accuracy, and a tendency to produce false or unreliable percussivity estimates. The methods are also relatively complex and thus expensive to implement, particularly the harmonic **spectral** component estimation method.

U.S. Patent No. 5,616,876 (Cluts et al) entitled "System and Methods for Selecting Music on the Basis of Subjective... ...to identify other songs similar to the seed song, the similarity between songs being based on the subjective content of the songs, as reflected in **style** tables prepared by editors. The system and methods described in this publication are based on the manual categorisation of music, with the attendant requirement for human participation in the process, with the resultant speed, accuracy and repeatability of the process limited by human **attributes**.

The publication entitled "Content - Based **Classification**, Search, and Retrieval of Audio" by Erling et al (IEEE Multimedia Vol. 3, No. 3, 1996, pp.27-36) discloses indexing and retrieving short audio files (i.e. "sounds") from a database. **Features** from the sound in question are extracted, and **feature vectors** based on statistical measures relating to the **features** are generated. Both the sound and the set of **feature vectors** are stored in a database for later search and retrieval. A method of **feature** comparison is used to determine whether or not a selected sound is similar to another sound stored in the database. The **feature** set selected does not include tempo and thus the system will not perform well in differentiating between pieces of music. Furthermore, the method determines **features** which provide scalar statistical measures over short time windows. Furthermore, the method uses **features** such as bandwidth which are not readily conceptualized in **terms** of impact of music selection.

It is seen from the above that existing arrangements have shortcomings in all elements in the hierarchy of requirements described... ...a method for querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of **parameters**, the method comprising the steps of:

forming a request which **specifies** one or more pieces of music and/or associated **parameters** and one or more conditional expressions;

determining associated **parameters** for the **specified** pieces of music if the **parameters** have not been **specified** ;

comparing the **specified parameters** and corresponding **parameters** associated with other pieces of music in the database;

calculating a distance based on the comparisons;

identifying pieces of music which are at distances from the **specified** pieces of music as to satisfy the conditional expressions.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention will be described in **detail** with reference to the accompanying drawings in which:

Fig. 1 depicts a music database system in a kiosk embodiment;

Fig. 2 illustrates a music database system in a network embodiment;

Fig. 3 provides a functional description of a music database system;

Fig. 4 illustrates a generic **feature** extraction process;

Fig. 5 depicts the tempo **feature** extraction process;

Fig. 6 presents a further illustration of the tempo **feature** extraction process;

Fig. 7 depicts a process flow diagram for a preferred embodiment of the percussivity estimator;

Fig. 8 presents more **detail** of the preferred embodiment;

Fig. 9 illustrates a preferred embodiment of a comb filter;

Fig. 10 depicts a linear function obtained from the comb filter... ...12 presents an accumulated histogram of a signal having an overall low percussivity;

Fig. 13 illustrates a typical percussive signal;

Fig. 14 depicts a generic **feature classification** process;

Fig. 15 shows a database query process - music identifiers supplied in query;

Fig. 16 illustrates a database query process - music **features** supplied in query;

Fig. 17 illustrates a distance metric used to assess similarity between two pieces of music; and

Fig. 18 - 21 depict **feature** representations for four pieces of music; and

Fig. 22 depicts a general purpose computer upon which the preferred embodiment of the invention can be practiced.

DETAILED DESCRIPTION

Fig. 1 depicts a music database system in a kiosk 102 embodiment. For the purpose of the description it is noted that "kiosk" is... ...to the kiosk and inputs a music query 104 to the kiosk 102, which after performing a search of the kiosk music database based on **parameters** in the music query 104, outputs a desired piece of music 106 which is based on the music query 104. The kiosk 102 also outputs... ...the desired piece of music 106. Such identifiers could include, for example, the name of the piece of music. Considering first the music input and **classification** process, a piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. In parallel with this process, the actual music piece itself 100 is stored in music database 302. Thus the piece of music 100 and its associated representative **features** are stored in two databases 302 and 308. Next considering the database query process, the user query 104 is input whereupon **feature** comparison 312 is performed between the **features** associated with the user query 104 and the **features** of the pieces of music stored in the **feature** database 308. After a successful search, a music selection process 314 extracts the desired piece of music 106 from music database 302 on the basis of the **feature** comparison 312, and outputs the desired piece of music 106 and/or music identifiers 108 associated with the desired piece of music 106.

Fig. 4 depicts a generic **feature** extraction process. Recalling from the functional description of the database system in Fig. 3, the piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. In Fig. 5, the piece of music 100 is input, and **feature** extraction process 304 is seen to include, in this illustration, four parallel processes, one for each **feature** . The tempo extraction process 402 operates upon the input piece of music 100 to produce tempo data output 404. The loudness extraction process 406 operates... ...416 and percussivity data output 418. Thus, referring again to Fig. 3 it is seen that for this example, the output line 332 between the **feature** comparison process 312 and the **feature** database 308 is handling four different data sets 504, 508, 512, 516.

Fig. 5 shows the tempo **feature** extraction process 402 (described in Fig. 4) and will be described in some **detail**. Tempo extraction firstly involves determination of the onset signal 620 from the piece of music 100, and then filtering this onset signal through a bank... ...card 216, where say a Fast Fourier Transform (FFT) can be performed using a Digital Signal Processor (DSP). Furthermore, comb filters, described in relation to **feature** extraction, can also be implemented using a DSP on the audio card 216. Alternatively, these processes can be performed by the general purpose processor 102... ...full duration of the piece of music 100. In an alternate embodiment, the onset signal 618 could be derived by sampling signal 628, comparing consecutive **samples** to detect positive peaks of the signal 614, and generating pulses 628 each time such a peak is detected. A brief explanation about the effect...

...Summing frequency component amplitudes in each window is a form of decimation (i.e. reduction of the sampling frequency), since the number of digitised music **samples** in a window are summed to form one resultant point. Thus selection of the window size has the effect of reducing the number of **sample** points. The optimum selection of window size requires a balance between the accuracy of the resultant representation of the **feature**, and compression of the data in order to reduce computational burden. The inventor has found that a 256 point FFT (equivalent to an 11.6 msec music window size) yields good performance when using the resultant **feature** for comparing and selecting music pieces in regard to tempo. Once significant changes in the **spectrum** (i.e. the starting points of notes 616) are located, the onset signal 618 is passed through a bank of comb filters in order to... ...output

xt)) represents the onset signal (618).

Each of these comb filters has a resonant frequency (at which the output is reinforced) determined by the **parameter** 1/(tau). The **parameter** (alpha) (alpha) corresponds to the amount of weighting placed on previous inputs relative to the amount of weighting placed on current and future inputs. The onset signal 618 is filtered through the bank of comb filters, whose resonant frequencies are placed at frequencies which are at multiple **sample** spacings resulting from windowing. The filters should typically cover the range from about 0.1Hz through to about 8Hz. The filter with the highest energy output at each **sample** point is considered to have "won", and a tally of wins is maintained for each filter in the filterbank, for example by using a power... ...present in the original music signal 100. Secondary tempo's may also be identified using the method.

The timbre of a sequence of sound, which **feature** is **characteristic** of the difference in sounds say between two musical instruments, is largely dependent upon the frequencies present, and their respective magnitudes.

The **spectral** centroid provides an estimate of "brightness" or "sharpness" of the sound, and is one of the metrics used in the present embodiment in relation to extraction of timbre. This brightness **characteristic** is given by: where:

S = **spectral** centroid

f = frequency

A = Amplitude

W = Window selected

In order to differentiate between the timbral **characteristics** of different audio signals, the present embodiment makes use of the Fourier transform of successive 0.5 second windows of the audio signal 100 in question. There is no necessary relationship between the window size used for loudness **feature** extraction and that used for tempo or other **feature** extraction. Other techniques for extracting timbre may be used.

Percussivity is that **attribute** which relates to a family of musical instruments known as "percussion" when considering an orchestra or a band. This family includes such musical instruments as... ...signal

736 is operated upon by a windowing process 710 which outputs a windowed signal on line 734, the windowed signal being shown in more **detail** in an inset 712. In the inset 712 windows, exemplified by a window 738, each having a predetermined width 708, are overlapped with each other... ...of individual comb filters exemplified by comb filter 718. The structure and operation of an embodiment of the comb filter 718 is presented in more **detail** in relation to Fig. 3. The comb filter 718 integrates the energy of the signal 736 across the particular window 738 being considered. The bank... ...process 722 which determines a straight line of best fit 732 which approximates the output signal exemplified by signal 726.

Fig. 8 presents a more **detailed** description of the preferred embodiment of the percussivity estimator as it relates to a digitised input signal. Given an input signal on line 800 to... ...between 200 Hz and 3000 Hz. The number and spacing of the individual comb filters 718 in the comb filter bank are discussed in more **detail** in relation to Fig. 9. The linear function on line 812 which is formed from the peak energy output of each comb filter comprising the... ...t) is an input signal 900 to the comb filter;

y(t) is an output signal 906 from the comb filter;

T is a delay **parameter** determining the period of the comb filter; and

a is a gain factor determining the frequency selectivity of the comb filter.

For each comb filter 718 in the bank of comb filters 740 (see Fig. 7), the delay factor T is selected to be an integral number of **samples** long, the **sample attributes** being determined by process 802 (see Fig. 8). In the preferred embodiment of the comb filter bank 740, the number of filters 718 in the bank 740 is determined by the number of integral **sample** lengths between the resonant frequency edges, these edges being defined in the embodiment described in relation to Fig. 8 to be 200 Hz and 3000... ...in the time domain, where the signal 1304 is plotted as a function of an amplitude axis 1300 and a time axis 1302.

The loudness **feature** is representative of the loudness over substantially the full duration of the piece of music 100 (see Fig. 1). The piece of music 100 is first partitioned into a sequence of time windows, which for the purpose of **classification** and comparison on the basis of loudness, should be preferably about one half a second wide. There is no necessary relationship between the window size used for loudness **feature** extraction and that used for tempo or other **feature** extraction. The Fourier transform of the signal in each window is taken, and then the power in each window is calculated. The magnitude of this... ...is an estimate of the loudness of the music within the corresponding half-second interval. Other methods of extracting loudness are known.

Pitch is another **feature** in the present embodiment determined by the **feature** extraction means in order to represent music while storing a new piece of music into the music database. The localised pitch is determined over a... ...0.1 seconds in this instance) by using a bank of comb filters. There is no necessary relationship between the window size used for pitch **feature** extraction and that used for tempo or other **feature** extraction. These comb filters have resonant frequencies covering a range of valid pitches. Advantageously this includes frequencies from around 200Hz up to around 3500Hz, and the filters are spaced at intervals determined by the rate at which the original musical signal was **sampled**. The **sampled** signal is filtered through the filter bank, and the comb filter that has the greatest

output power will have a resonant frequency corresponding to the... ...a number of methods for pitch extraction which exists and other methods may be used.

Returning to Fig. 3, and considering the music input and **classification** process, when the piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. Substantially in parallel with this process, the actual music piece itself 100 is stored in music database 302. Thus the piece of music 100 and the associated representative **features** are stored in two distinct but related databases 302 and 308 respectively. If the music is initially derived from an analogue source, it is first digitised before being input into the **feature** extraction process 304. The digitisation step may be implemented by way of a standard soundcard or, if the music is already in digital form, this Musical Instrument Digital Interface (MIDI) format and others may be supported in the system. There are no **specific** requirements in **terms** of sampling rate, bits per **sample**, or channels, but it should be noted that if higher reproduction **quality** is desirable it is preferable to select an audio resolution close to that of a CD.

Fig. 14 depicts a generic **feature classification** process. Extracted **feature** signals 404, 408, 412, 416 and 418 (refer Fig. 4) are accumulated in process step 1404 as histograms over substantially the whole duration of the piece of music 100 resulting in an indicative **feature** output 1406 for each extracted **feature** signal. This output 1406 is stored in the **feature** database 308. By identifying the N highest tempo's in the manner described in Figs. 5 and 6, a histogram describing the relative occurrence of... ...pitches, a histogram describing the relative occurrence of each pitch across substantially the whole duration of the piece of music 100 can be formed. The **spectral** centroid is advantageously used to describe the sharpness in a window. This can be accumulated as a histogram over substantially the full duration of the... ...a histogram describing the relative occurrence of each sharpness across substantially the whole duration of the piece of music 100 can be formed. Accumulation of **features** as histograms across substantially the entire duration of pieces of music yields a duration independent mechanism for **feature classification** suitable for search and comparison between pieces of music. This forms the foundation for **classification** in the music database system. The **spectral** centroid is advantageously used to describe the percussivity in a window. This can be accumulated as a histogram over substantially the full duration of the... ...of forms which include, but are not limited to:

(1) a set of names of known pieces of music and a degree of similarity/dissimilarity **specified** by a conditional expression (shown underlined) for each piece (e.g. very much like "You can hear me in the harmony" by Harry Conick Jr., a little like "1812 Overture" by Tchaikovsky, and not at all like "Breathless" by Kenny G);

(2) a set of user **specified features** and a similarity/dissimilarity **specification** in the form of a conditional expression (e.g. something that has a tempo of around 120 beats per minute, and is mostly **loud**).

In Fig. 15, the music query 104, containing music identifiers and conditional expressions is input into the **feature** comparison process 312 (see Fig. 3). This process 312 includes the **feature** retrieval process 1502 which retrieves the **features** associated with the pieces of music named in the music query 104 from **feature** database 308. Next these retrieved **features** are passed to similarity comparison process 1504 which searches the **feature** database 308 for **features** satisfying the conditional expression contained in music query 104 as applied to the **features** associated with pieces of music named in music

query 104. The results of this comparison are passed to the identifier retrieval process 1506 which retrieves the music identifiers of the pieces of music whose **features** satisfy the conditional expressions as applied to the identifiers **specified** in music query 104. These identifiers are passed to the music selection process 314 which enables the output of the desired music 106 and/or music identifiers 108 from music database 302 and **feature** database 308 respectively.

Fig. 16 describes a database query process where music **features** are supplied in the music query 104. The music query 104, containing music **features** and conditional expressions, is available at the query stage 104 and thus in this case the **feature** retrieval process 1502 is bypassed (see Fig. 15). Next these provided **features** are passed to the similarity comparison process 1604 which searches the **feature** database 308 for **features** satisfying the conditional expression contained in music query 104 as applied to the **features** provided in the music query 104. The results of this comparison are passed to the identifier retrieval process 1606 which retrieves the music identifiers of the pieces of music whose **features** satisfy the conditional expressions in relation to the identifiers **specified** in music query 104. These identifiers are passed to the music selection process 314 which ensures the output of the desired music 106 and/or music identifiers 108 from music database 302 and **feature** database 308 respectively.

Considering the process of **feature** comparison 312, a similarity comparison is performed between the **features** of music stored by the system in the **feature** database 308 which correspond to pieces of music 100 stored in music database 302, and **features** corresponding to the music query 104. Since a number of different **features** (and **feature** representations) exist in the **feature** database 308, the comparisons between corresponding **features** are advantageously performed differently for each **feature**, for example:

* comparison between loudness **features** stored as histograms are made through the use of a histogram difference. or comparison of a number of moments about the mean of each histogram. or other methods that achieve the same goal;

* comparison between tempo **features** stored as histograms are accomplished by methods such as histogram difference, or comparison of a number of moments about the mean of each histogram or other methods that achieve the same goal,

* comparison between pitch **features** stored as histograms are performed using a histogram difference, or a comparison of a number of moments about the mean of each histogram. Other methods for comparison of pitch **features** may also be used,

* comparison between sharpness **features** stored as histograms are achieved through the use of methods such as histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal, and

* comparison between percussivity **features** stored as histograms are achieved through the use of methods such as histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal.

Once the comparison of each of the relevant **features** has been made, the overall degree of similarity is ascertained. A simple, yet effective way of determining this is through the use of a distance metric (also

known as the Minkowski metric with r = 1), with each of the **feature** comparison results representing an individual difference along an orthogonal axis.

Fig. 17 illustrates a distance metric used to assess the similarity between two pieces of music where D is the distance between the two pieces of music 1708 and 1710 (only 3 **features** are shown for ease of representation). In this case, a smaller value of D represents a greater similarity. D is advantageously represented by:

Fig. 17 illustrates the distance between two pieces of music 1708, 1710, these pieces of music being defined in **terms** of three exemplary **features** namely pitch 1702, tempo 1704, and sharpness 1706. Distance D 1712 represents the distance between the pieces of music 1710 and 1708 when measured in this context.

The above method will be partially described for a **specific** query 104 namely "Find a piece of music similar to piece A", where the database contains pieces of music A, B, C, and D. This query 104 is of a **type** described in Fig. 15 where music identifiers (ie the name of the piece of music "A") and a conditional expression ("similar to") is provided in the **query** 104.

Each piece of **music** stored in the database is represented by a number of **features** that have been extracted when the pieces were classified and stored in the database. For the sake of simplicity the **example presented** is restricted to two **features**, namely tempo and sharpness, where both **features** are represented by simplified histograms.

The four music pieces to be considered are named A, B, C and D. Their corresponding **feature** histograms are illustrated in Figs. 18-21.

Fig. 18 illustrates a tempo histogram and a timbre (alternatively called sharpness) histogram for piece of music A... ...22050 Hz (1804) for 20% of the time (1810) and a brightness of 44100 Hz (1806) for 80% of the time (1812). Figs. 19 - 21 **display similar features** for pieces of **music** B - D.

When the **query** is presented, the following sequence of operations is performed:

* Comparison of the **features** of A and B

* Comparison of the **features** of A and C

* Comparison of the **features** of A and D

* Selection of the music that is least distant from A

Since all **features** of the music in the database are preferably represented as histograms, comparisons between these **features** is based on a comparison between the histograms. Two methods that are useful in forming this comparison are the histogram difference, and the comparison of... ...histogram difference, the calculation of distance is performed as follows:

The difference between A and B in regard to tempo is: where the number of **terms** in the numerator is determined by the number of histogram points being compared, and the denominator is determined by the fact that two histograms are... ...B in regard to timbre:

Thus, distance between A and B is given by:

If we consider the histograms in Figs. 18-21 for the **features** extracted from the piece of music A, B, C and D:

Music A, tempo histogram:

Music A, sharpness histogram:

Music B, tempo histogram:

Music B... ...however, the other pieces of music in the database namely D, E, ..., K, ... would be assessed in order to establish which piece of music had **features** which could simultaneously satisfy the requirements of being at a minimum distance from A, a larger distance from B, and a maximum distance from C.

It is further possible to apply a weighting to each individual **feature** in order to bias the overall distance metric in some fashion (for example biasing in favour of tempo similarity rather than loudness similarity).

In considering similarity assessment on the basis of either the histogram difference, or the comparison of moments, these being applied to the **attributes** of pitch, loudness, tempo, and timbre (i.e. sharpness and percussivity), it is found that two-pass assessment provides better **classification** results in some cases. The two-pass assessment process performs a first assessment on the basis of loudness, percussivity and sharpness. and then a second sorting process based on tempo. In the present embodiments, it is found that the **feature** of pitch may be omitted from the similarity assessment process without significantly degrading the overall similarity assessment results.

In considering similarity assessment using the comparison of moments process, good results are produced by selecting particular moments for each **feature** as shown in the following table: where "mean" and "variance" are determined in accordance with the following general form which expresses moments about the mean... ...the peak, and represents the relative strength of the dominant tempo.

Application of clustering techniques to a complete set of moments corresponding to the extracted **features**, including the mode of each histogram, provides better **classification** results in some cases. Use of Bayesian estimation produces a "best" set of classes by which a given dataset may be classified.

Fig. 22 shows... ...executed by the computer 2200. The use of the computer program product in the computer preferably effects an apparatus for (i) extracting one or more **features** from a music signal, said **features** including, for instance, tempo, loudness, pitch, and timbre, (ii) **classification** of music using extracted **features**, and (iii) method of querying a music database. Corresponding systems upon which the above method steps may be practised may be implemented as described by...

Specification: ...The present invention relates to the field of music systems and, in particular, to the identification and retrieval of particular pieces of music or alternately, **attributes** of a desired piece of music, from a music database on the basis of a query composed of desired **features** and conditional statements. BACKGROUND OF THE INVENTION

Retrieval of music or music **attributes** from a database requires, in common with generic database functionality, a query method which is powerful and flexible, and preferably intuitively meaningful to the user... ...to systematic search and sort procedures. This latter aspect in turn requires that pieces of music be characterised in a manner which permits of such **classification**.

Thus a hierarchy of requirements or elements which make up a music database system are as follows:

characterising music using **attributes** useful in a **classification** scheme

classifying music in a meaningful searchable structure, and

querying the database so formed, to yield meaningful results.

The hierarchy has been defined "bottom up... ...a more meaningful progression by which the invention can be described.

When considering audio signals in general, and in particular those relating to music, the **nature** of the signals may be considered in **terms** of various **attributes** which are intuitively meaningful. These **attributes** include, among others, tempo, loudness, pitch and timbre. Timbre can be considered to be made up of a number of constituent sub-**features** including "sharpness" and "percussivity". These **features** can be extracted from music and are useful in characterising the music for a **classification** scheme.

The publication entitled "**TYPE**=B> Using Bandpass and Comb Filters to Beat-track Digital Audio" by Eric D. Scheirer (MIT Media Laboratory, December 20, 1996) discloses a method... ...desktop workstation or alternately, a multi-processor architecture may be utilised. This method suffers from the disadvantage of being highly computationally intensive.

Percussivity is that **attribute** which relates to a family of musical instruments known as "percussion" when considering an orchestra or a band. This family includes such musical instruments as drums, cymbals, castanets and others. Processing of audio signals in general and musical signals in particular, benefits from the ability to estimate various **attributes** of the signals, and the present invention also addresses estimating the **attribute** of percussivity.

A number of different methods have been used to estimate percussivity of a given signal, such methods including those broadly based upon:

Short-time power analysis

statistical analysis of signal amplitude

comparison of harmonic **spectral** component power with total **spectral** power

Short-time signal power estimation involves calculation of an equivalent power (or an approximation thereof) within a short segment or "window" of a signal... ...The power estimate can be compared to a threshold in order to determine whether the portion of the signal within the window is percussive in **nature**.

Alternatively, the power estimate can be compared to a sliding scale of thresholds, and the percussive content of the signal classified with reference to the... ...in a neighborhood in order to determine whether signal variations in the running mean are sufficiently large to signify that the signal is percussive.

Harmonic **spectral** component power analysis involves taking a windowed Fourier transform of the signal in question over the time period of interest, and then examining the resulting set of **spectral** components. The **spectral** components which are indicative of harmonic series are removed. It is noted that such harmonic series components typically represent local maxima in the overall **spectral** envelope of the signal. After removing the harmonic series **spectral** components, remaining **spectral** components substantially consist only of the inharmonic components of the signal, these being considered to represent percussive components of the signal. The total power in... ...all components, harmonic and non-harmonic, to yield an indication of percussivity.

The aforementioned analysis methods are typically intended to identify a range of signal **attributes**, and thus suffer from relatively limited accuracy, and a tendency to produce false or unreliable percussivity estimates. The methods are also relatively complex and thus expensive to implement, particularly the harmonic **spectral** component estimation method.

U.S. Patent No. 5,616,876 (Cluts et al) entitled "System and Methods for Selecting... ...to identify other songs similar to the seed song, the similarity between songs being based on the subjective content of the songs, as reflected in **style** tables prepared by editors. The system and methods described in this publication are based on the manual categorisation of music, with the attendant requirement for human participation in the process, with the resultant speed, accuracy and repeatability of the process limited by human **attributes**.

The publication entitled "**TYPE**=S> Content - Based **Classification**, Search, and Retrieval of Audio" by Wold et al (IEEE Multimedia Vol. 3, No. 3, 1996, pp.27-36) discloses indexing and retrieving short audio files (i.e. "sounds") from a database. **Features** from the sound in question are extracted, and **feature vectors** based on statistical measures relating to the **features** are generated. Both the sound and the set of **feature vectors** are stored in a database for later search and retrieval. The **feature** set selected does not include tempo and thus the system will not perform well in differentiating between pieces of music. Furthermore, the method determines **features** which provide scalar statistical measures over short time windows. Furthermore, the method uses **features** such as bandwidth which are not readily conceptualized in **terms** of impact of music selection.

The publication entitled "**TYPE**=S> Music Databases: Indexing Techniques and Implementation" by Chou et al, International Workshop on Multimedia Database Management Systems, Proceedings of International Workshop and Multimedia Database... ...database, a corresponding apparatus and a computer readable medium.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention will be described in **detail** with reference to the accompanying drawings in which:

Fig. 1 depicts a music database system in a kiosk embodiment;

< IDREF...>

Fig. 3 provides a functional description of a music database system;

Fig. 4 illustrates a generic **feature** extraction process;

Fig. 5 depicts the tempo **feature** extraction process;

Fig. 6 presents a further illustration of the tempo **feature** extraction process;

Fig. 7 depicts a process flow diagram for a preferred embodiment of the percussivity estimator;

Fig. 8 presents more **detail** of the preferred embodiment;

Fig. 9 illustrates a preferred embodiment of a comb filter;

Fig. 10 depicts... ...having an overall low percussivity;

Fig. 13 illustrates a typical percussive signal;

Fig. 14 depicts a generic **feature classification** process;

Fig. 15 shows a database query process - music identifiers supplied in query;

Fig. 16 illustrates a database query process - music **features** supplied in query;

Fig. 17 illustrates a distance metric used to assess similarity between two pieces of music; and

Fig. 18 - 21 depict **feature** representations for four pieces of music; and

Fig. 22 depicts a general purpose computer upon which the preferred embodiment of the invention can be practiced.

DETAILED DESCRIPTION

Fig. 1 depicts a music database system in a kiosk 102 embodiment. For the purpose of the description it is... ...to the kiosk and inputs a music query 104 to the kiosk 102, which after performing a search of the kiosk music database based on **parameters** in the music query 104, outputs a desired piece of music 106 which is based on the music query 104. The kiosk 102 also outputs... ...the desired piece of music 106.

Such identifiers could include, for example, the name of the piece of music. Considering first the music input and **classification** process, a piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. In parallel with this process, the actual music piece itself 100 is stored in music database 302. Thus the piece of music 100 and its associated representative **features** are stored in two databases 302 and 308. Next considering the database query process, the user query 104 is input whereupon **feature** comparison 312 is performed between the **features** associated with the user query 104 and the **features** of the pieces of music stored in the **feature** database 308. After a successful search, a music selection process 314 extracts the desired piece of music 106 from music database 302 on the basis of the **feature** comparison 312, and outputs the desired piece of music 106 and/or music identifiers 108 associated with the desired piece of music 106.

Fig. 4 depicts a generic **feature** extraction process. Recalling from the functional description of the database system in Fig. 3, the piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. In Fig. 5, the piece of music 100 is input, and **feature** extraction process 304 is seen to include, in this illustration, four parallel processes, one for each **feature**. The tempo extraction process 402 operates upon the input piece of music 100 to produce tempo data output 404. The loudness extraction process 406 operates... ...output 418. Thus, referring again to Fig. 3 it is seen that for this example, the output line 332 between the **feature** comparison process 312 and the **feature** database 308 is handling five different data sets 404, 408, 412, 416 and 418.

Fig. 5 shows the tempo **feature** extraction process 402 (described in Fig. 4) and will be described in some **detail**. Tempo extraction firstly involves determination of an onset signal 618 (shown in Fig. 6) from the piece of music 100, and ... ...22), where say a Fast Fourier Transform (FFT) can be performed using a Digital Signal Processor (DSP). Furthermore, comb filters, described in relation to **feature** extraction, can also be implemented using a DSP on the audio card 2216. Alternatively, these processes can be performed by the general purpose processor 2204... ...full duration of the piece of music 100. In an alternate embodiment, the onset signal 618 could be derived by sampling signal 628, comparing consecutive **samples** to detect positive peaks of the signal 614, and generating pulses 628 each time such a peak is detected. A brief explanation about the effect... ...Summing frequency component amplitudes in each window is a form of decimation (i.e. reduction of the sampling frequency), since the number of digitised music **samples** in a window are summed to form one resultant point. Thus selection of the window size has the effect of reducing the number of **sample** points. The optimum selection of window size requires a balance between the accuracy of the resultant representation of the **feature**, and compression of the data in order to reduce computational burden. The inventor has found that a 256 point FFT (equivalent to an 11.6 msec music window size) yields good performance when using the resultant **feature** for comparing and selecting music pieces in regard to tempo. Once significant changes in the **spectrum** (i.e. the starting points of notes 616) are located, the onset signal 618 is passed through a bank of comb filters in order to... ...x t)) represents the onset signal (618).

Each of these comb filters has a resonant frequency (at which the output is reinforced) determined by the **parameter** / tau 1 . The **parameter** alpha (alpha) corresponds to the amount of weighting placed on previous inputs relative to the amount of weighting placed on current and future inputs. The onset signal 618 is filtered through the bank of comb filters, whose resonant frequencies are placed at frequencies which are at multiple **sample** spacings resulting from windowing. The filters should typically cover the range from about 0.1Hz through to about 8Hz. The filter with the highest energy output at each **sample**

point is considered to have "won", and a tally of wins is maintained for each filter in the filterbank, for example by using a power... ...present in the original music signal 100. Secondary tempo's may also be identified using the method.

The timbre of a sequence of sound, which **feature** is **characteristic** of the difference in sounds say between two musical instruments, is largely dependent upon the frequencies present, and their respective magnitudes.

The **spectral** centroid provides an estimate of "brightness" or "sharpness" of the sound, and is one of the metrics used in the present embodiment in relation to extraction of timbre. This brightness **characteristic** is given by: s = (sum) w f A / (sum) * A

where:

S = **spectral** centroid

f = frequency

A = Amplitude

W = Window selected

In order to differentiate between the timbral **characteristics** of different audio signals, the present embodiment makes use of the Fourier transform of successive 0.5 second windows of the audio signal 100 in question. There is no necessary relationship between the window size used for loudness **feature** extraction and that used for tempo or other **feature** extraction. Other techniques for extracting timbre may be used.

Percussivity is that **attribute** which relates to a family of musical instruments known as "percussion" when considering an orchestra or a band. This family includes such musical instruments as... ...signal 736 is operated upon by a windowing process 710 which outputs a windowed signal on line 734, the windowed signal being shown in more **detail** in an inset 712. In the inset 712 windows, exemplified by a window 738, each having a predetermined width 708, are overlapped with each other... ...of individual comb filters exemplified by comb filter 718. The structure and operation of an embodiment of the comb filter 718 is presented in more **detail** in relation to Fig. 9. The comb filter 718 integrates the energy of the signal 736 across the particular window 738... ...best fit 732 (shown in inset 730) which approximates the output signal exemplified by signal 726.

Fig. 8 presents a more **detailed** description of the preferred embodiment of the percussivity estimator as it relates to a digitised input signal. Given an input signal on line 800 to... ...between 200 Hz and 3000 Hz. The number and spacing of the individual comb filters 718 in the comb filter bank are discussed in more **detail** in relation to Fig. 9. The linear function on line 812 which is formed from the peak energy output of each... ...t) is an input signal 900 to the comb filter;

y(t) is an output signal 906 from the comb filter;

T is a delay **parameter** determining the period of the comb filter; and

a is a gain factor determining the frequency selectivity of the comb filter.

For each comb filter... ...the bank of comb filters 740 (see Fig. 7), the delay factor T is selected to be an integral number of **samples** long, the **sample attributes** being determined by process 802 (see Fig. 8). In the preferred embodiment of the comb filter bank 740, the number of filters 718 in the bank 740 is determined by the number of integral **sample** lengths between the resonant frequency edges, these edges being defined in the embodiment described in relation to Fig. 8 to be... ...in the time domain, where the signal 1304 is plotted as a function of an amplitude axis 1300 and a time axis 1302.

The loudness **feature** is representative of the loudness over substantially the full duration of the piece of music 100 (see Fig. 1). The piece of music 100 is first partitioned into a sequence of time windows, which for the purpose of **classification** and comparison on the basis of loudness, should be preferably about one half a second wide. There is no necessary relationship between the window size used for loudness **feature** extraction and that used for tempo or other **feature** extraction. The Fourier transform of the signal in each window is taken, and then the power in each window is calculated. The magnitude of this... ...is an estimate of the loudness of the music within the corresponding half-second interval. Other methods of extracting loudness are known.

Pitch is another **feature** in the present embodiment determined by the **feature** extraction means in order to represent music while storing a new piece of music into the music database. The localised pitch is determined over a... ...0.1 seconds in this instance) by using a bank of comb filters. There is no necessary relationship between the window size used for pitch **feature** extraction and that used for tempo or other **feature** extraction. These comb filters have resonant frequencies covering a range of valid pitches. Advantageously this includes frequencies from around 200Hz up to around 3500Hz, and the filters are spaced at intervals determined by the rate at which the original musical signal was **sampled**. The **sampled** signal is filtered through the filter bank, and the comb filter that has the greatest output power will have a resonant frequency corresponding to the... ...for pitch extraction which exists and other methods may be used.

Returning to Fig. 3, and considering the music input and **classification** process, when the piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. Substantially in parallel with this process, the actual music piece itself 100 is stored in music database 302. Thus the piece of music 100 and the associated representative **features** are stored in two distinct but related databases 302 and 308 respectively. If the music is initially derived from an analogue source, it is first digitised before being input into the **feature** extraction process 304. The digitisation step may be implemented by way of a standard soundcard or, if the music is already in digital form, this... ...for 100. Thus, arbitrary digitization structures including the Musical Instrument Digital Interface (MIDI) format and others may be supported in the system. There are no **specific** requirements in **terms** of sampling rate, bits per **sample**, or channels, but it should be noted that if higher reproduction **quality** is desirable it is preferable to select an audio resolution close to that of a CD.

Fig. 14 depicts a generic **feature classification** process. Extracted **feature** signals 404, 408, 412, 416 and 418 (refer Fig. 4) are accumulated in process step 1404 as histograms over substantially the whole

duration of the piece of music 100 resulting in an indicative **feature** output 1406 for each extracted **feature** signal. This output 1406 is stored in the **feature** database 308. By identifying the N highest tempos in the manner described in Figs. 5 and 6**spectral** centroid is advantageously used to describe the sharpness in a window. This can be accumulated as a histogram over substantially the full duration of the... ...a histogram describing the relative occurrence of each sharpness across substantially the whole duration of the piece of music 100 can be formed. Accumulation of **features** as histograms across substantially the entire duration of pieces of music yields a duration independent mechanism for **feature classification** suitable for search and comparison between pieces of music. This forms the foundation for **classification** in the music database system. The **spectral** centroid is advantageously used to describe the percussivity in a window. This can be accumulated as a histogram over substantially the full duration of the... ...forms which include, but are not limited to:

1. (1) a set of names of known pieces of music and a degree of similarity/dissimilarity **specified** by a conditional expression (shown underlined) for each piece (e.g. very much like "You can hear me in the harmony" by Harry Conick Jr., a little like "1812 Overture" by Tchaikovsky, and not at all like "Breathless" by Kenny G);

2. (2) a set of user **specified features** and a similarity/dissimilarity **specification** in the form of a conditional expression (e.g. something that has a tempo of around 120 beats per minute, and is mostly **loud**).

In Fig. 15, the music query 104, containing music identifiers and conditional expressions is input into the **feature** comparison process 312 (see Fig. 3). This process 312 includes the **feature** retrieval process 1502 which retrieves the **features** associated with the pieces of music named in the music query 104 from **feature** database 308. Next these retrieved **features** are passed to similarity comparison process 1504 which searches the **feature** database 308 for **features** satisfying the conditional expression contained in music query 104 as applied to the **features** associated with pieces of music named in music query 104. The results of this comparison are passed to the identifier retrieval process 1506 which retrieves the music identifiers of the pieces of music whose **features** satisfy the conditional expressions as applied to the identifiers **specified** in music query 104. These identifiers are passed to the music selection process 314 which enables the output of the desired music 106 and/or music identifiers 108 from music database 302 and **feature** database 308 respectively.

Fig. 16 describes a database query process where music **features** are supplied in the music query 104. The music query 104, containing music **features** and conditional expressions, is available at the query stage 104 and thus in this case the **feature** retrieval process 1502 is bypassed (see Fig. 15). Next these provided **features** are passed to the similarity comparison process 1604 which searches the **feature** database 308 for **features** satisfying the conditional expression contained in music query 104 as applied to the **features** provided in the music query 104. The results of this comparison are passed to the identifier retrieval process 1606 which retrieves the music identifiers of the pieces of music whose **features** satisfy the conditional expressions in relation to the identifiers **specified** in music query 104. These identifiers are passed to the music selection process 314 which ensures the output of the desired music 106 and/or music identifiers 108 from music database 302 and **feature** database 308 respectively.

Considering the process of **feature** comparison 312, a similarity comparison is performed between the **features** of music stored by the system in the **feature** database 308 which correspond to pieces of music

100 stored in music database 302, and **features** corresponding to the music query 104. Since a number of different **features** (and **feature** representations) exist in the **feature** database 308, the comparisons between corresponding **features** are advantageously performed differently for each **feature**, for example:

comparison between loudness **features** stored as histograms are made through the use of a histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal;

comparison between tempo **features** stored as histograms are accomplished by methods such as histogram difference, or comparison of a number of moments about the mean of each histogram or other methods that achieve the same goal,

comparison between pitch **features** stored as histograms are performed using a histogram difference, or a comparison of a number of moments about the mean of each histogram. Other methods for comparison of pitch **features** may also be used,

comparison between sharpness **features** stored as histograms are achieved through the use of methods such as histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal, and

comparison between percussivity **features** stored as histograms are achieved through the use of methods such as histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal.

Once the comparison of each of the relevant **features** has been made, the overall degree of similarity is ascertained. A simple, yet effective way of determining this is through the use of a distance metric (also known as the Minkowski metric with r = 1), with each of the **feature** comparison results representing an individual difference along an orthogonal axis.

Fig. 17 illustrates a distance metric used to assess the similarity between two pieces of music where D is the distance between the two pieces of music 1708 and 1710 (only 3 **features** are shown for ease of representation). In this case, a smaller value of D represents a greater similarity. D is advantageously represented by: SQRT loudness... ...difference 2

Fig. 17 illustrates the distance between two pieces of music 1708, 1710, these pieces of music being defined in **terms** of three exemplary **features** namely pitch 1702, tempo 1704, and sharpness 1706. Distance D 1712 represents the distance between the pieces of music 1710 and 1708 when measured in this context.

The above method will be partially described for a **specific** query 104 namely "Find a piece of music similar to piece A", where the database contains pieces of music A, B, C, and D. This query 104 is of a **type** described in Fig. 15 where music identifiers (ie the name of the piece of music "A") and a conditional expression ("similar to") is provided in the **query** 104.

Each piece of **music** stored in the database is represented by a number of **features** that have been extracted when the pieces were classified and stored in the database. For the sake of simplicity the **example presented** is restricted to two **features**, namely tempo and sharpness, where both **features** are represented by simplified histograms.

The four music pieces to be considered are named A, B, C and D. Their corresponding **feature** histograms are illustrated in Figs. 18-21.

Fig. 18 illustrates a tempo histogram and a... ...of the time (1810) and a brightness of 44100 Hz (1806) for 80% of the time (1812). Figs. 19 - 21 **display similar features** for pieces of **music** B - D.

When the **query** is presented, the following sequence of operations is performed:

Comparison of the **features** of A and B

Comparison of the **features** of A and C

Comparison of the **features** of A and D

Selection of the music that is least distant from A

Since all **features** of the music in the database are preferably represented as histograms, comparisons between these **features** is based on a comparison between the histograms. Two methods that are useful in forming this comparison are the histogram difference, and the comparison of... ...and B in regard to tempo is: 0.5 - 0.33 + 0.5 - 0.33 + 0 - 0.33 2 = 0.335

where the number of **terms** in the numerator is determined by the number of histogram points being compared, and the denominator is determined by the fact that two histograms are... ...0.7 2 + 0.335 2 = 0.776

If we consider the histograms in Figs. 18-21 for the **features** extracted from the piece of music A, B, C and D:

Music A, tempo histogram:

Music A, sharpness histogram:

Music B, tempo histogram:

Music B... ...however, the other pieces of music in the database namely D, E, ..., K, ... would be assessed in order to establish which piece of music had **features** which could simultaneously satisfy the requirements of being at a minimum distance from A, a larger distance from B, and a maximum distance from C.

It is further possible to apply a weighting to each individual **feature** in order to bias the overall distance metric in some fashion (for example biasing in favour of tempo similarity rather than loudness similarity).

In considering similarity assessment on the basis of either the histogram difference, or the comparison of moments, these being applied to the **attributes** of pitch, loudness, tempo, and timbre (i.e. sharpness and percussivity), it is found that two-pass assessment provides better **classification** results in some cases. The two-pass assessment process performs a first assessment on the basis of loudness, percussivity and sharpness, and then a second sorting process based on tempo. In the present embodiments, it is found that the **feature** of pitch may be omitted from the similarity assessment process without significantly degrading the overall similarity assessment results.

In considering similarity assessment using the comparison of moments process, good results are produced by selecting particular moments for each **feature** as shown in the following table: where "mean" and "variance" are determined in accordance with the following general form which expresses moments about the mean... ...the peak, and represents the relative strength of the dominant tempo.

Application of clustering techniques to a complete set of moments corresponding to the extracted **features**, including the mode of each histogram, provides better **classification** results in some cases. Use of Bayesian estimation produces a "best" set of classes by which a given dataset may be classified.

features from a music signal, said **features** including, for instance, tempo, loudness, pitch, and timbre, (ii) **classification** of music using extracted **features**, and (iii) method of querying a music database. Corresponding systems upon which the above method steps may be practised may be implemented as described by...

Claims: ...A method for querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to one or more **parameters**, the method comprising the steps of:

(a) forming a request which **specifies** one or more pieces of music and/or associated **parameters** and one or more conditional expressions;

(b) determining associated **parameters** for the **specified** pieces of music if the **parameters** have not been **specified** ;

(c) comparing the **specified parameters** and corresponding **parameters** associated with other pieces of music in the database;

(d) calculating a distance based on the comparisons; and

(e) identifying pieces of music which are at distances from the **specified** pieces of music as to satisfy the conditional expressions.

2. A method according to claim 1, including the further steps of:

(f) outputting at least... ...pieces are in a class of the plurality of pieces of music in the database.

6. A method according to any preceding claim, whereby a **classification** according to which the pieces of music are indexed uses **feature** extraction, the method further comprising the steps of:

(g) segmenting a piece of music over time into a plurality of windows;

(h) extracting one or more **features** in each of said windows; and

(i) arranging the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

7. A method according to claim 6, whereby a first **feature** extracted in step (h) is at least one tempo extracted from a digitised music signal, the **feature** extraction comprising the further sub-steps of:

(ha) segmenting the music signal into a plurality of windows;

(hb) determining values indicative of the energy in... ...the onset signal is formed in sub-step (hd) according to the further sub-sub-steps of:

(hdc) sampling the energy signal;

(hdd) comparing consecutive **samples** to determine a positive peak; and

(hde) generating a single pulse when each positive peak is detected.

12. A method according to any of claims... ...wherein the filter process resonant frequencies span a frequency range substantially between 1Hz and 4Hz.

13. A method according to claim 6, whereby a second **feature** extracted in step (h) is a percussivity of a signal, the method comprising the sub-steps of:

(hh) segmenting the signal into a plurality of... ...An apparatus for querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to one or more **parameters** the apparatus comprising:

(a) a request means for forming a request which **specifies** one or more pieces of music and/or associated **parameters** and one or more conditional expressions;

(b) a **parameter** determination means for determining associated **parameters** for the **specified** pieces of music if the **parameters** have not been **specified** ;

(c) a comparison means for comparing the **specified parameters** and corresponding **parameters** associated with other pieces of music in the database;

(d) a distance determination means for calculating a distance based on the comparisons; and

(e) a determination means for identifying pieces of music which are at distances from the **specified** pieces of music as to satisfy the conditional expressions.

19. An apparatus according to claim 18, wherein the apparatus further comprises:

(f) an output means... ...means for clustering the pieces of music in the database into classes.

22. An apparatus according to any of claims 18 to 21, whereby a **classification** according to which the pieces of music are indexed uses **feature** extraction means, the means comprising:

(g) segmentation means for segmenting an entire piece of music over time into a plurality of windows;

(h) **feature** extraction means for extracting one or more **features** in each of said windows; and

(i) histogram determination means for arranging the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

23. An apparatus method according to claim 22, whereby a first **feature** extracted in step (h) is at least one tempo extracted from a digitised music signal, and wherein the **feature** extraction means comprise:

(ha) segmentation means for segmenting the music signal into a plurality of windows;

(hb) energy determination means for determining values indicative of... ...wherein the onset signal generation means in sub-step (hd) comprise:

(hdc) sampling means for sampling the energy signal;

(hdd) comparator means for comparing consecutive **samples** to determine a positive peak; and

(hde) pulse generation means for generating a single pulse when each positive peak is detected.

28. An apparatus according... ...the comb filter means resonant frequencies span a frequency range substantially between 1Hz and 4Hz.

29. An apparatus according to claim 22, whereby a second **feature** extracted in step (h) is a percussivity of a signal, and wherein the **feature** extraction means comprise:

(hh) segmentation means for segmenting the signal into a plurality of windows, and for each window;

(hi) filtering means for filtering by... ...program product for querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to one or more **parameters** said computer program product comprising:

(a) a request means for forming a request which **specifies** one or more pieces of music and/or associated **parameters** and one or more conditional expressions;

(b) a **parameter** determination means for determining associated **parameters** for the **specified** pieces of music if the **parameters** have not been **specified**;

(c) a comparison means for comparing the **specified parameters** and corresponding **parameters** associated with other pieces of music in the database;

(d) a distance determination means for calculating a distance based on the comparisons; and

(e) a determination means for identifying pieces of music which are at distances from the **specified** pieces of music as to satisfy the conditional expressions.

35. A computer readable medium according to claim 34 said computer program product comprising:

(f) an... ...clustering the pieces of music in the database into classes.

38. A computer readable medium according to any of claims 34 to 37, whereby a **classification** according to which the pieces of music are indexed uses **feature** extraction means, said computer program product comprising:

(g) segmentation means for segmenting an entire piece of music over time into a plurality of windows;

(h) **feature** extraction means for extracting one or more **features** in each of said windows; and

(i) histogram determination means for arranging the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

39. A computer readable medium method according to claim 38, whereby a first **feature** extracted in step (h) is at least one tempo extracted from a digitised music signal, and wherein said computer program product comprising:

(ha) segmentation means... ...to the onset signal generation means in sub-step (hd) comprises:

(hdc) sampling means for sampling the energy signal;

(hdd) comparator means for comparing consecutive **samples** to determine a positive peak; and

(hde) pulse generation means for generating a single pulse when each positive peak is detected.

44. A computer readable... ...filter means resonant frequencies spaning a frequency range substantially between 1Hz and 4Hz.

45. A computer readable medium according to claim 38, whereby a second **feature** extracted in step (h) is a percussivity of a signal, and wherein said computer program product relating to the **feature** extraction means comprise:

(hh) segmentation means for segmenting the signal into a plurality of windows, and for each window;

(hi) filtering means for filtering by... ...music, the method comprising the steps of:

receiving a user request for one or more pieces of music from the database;

generating one or more **features** representative of the **style** of the requested one or more pieces of music;

determining one or more **features** representative of the **style** of each piece of music in said database, if those **features** have not already been determined,

comparing the one or more **features** representative of the **style** of the pieces of music in the database with the one or more **features** representative of the one or more pieces of music requested by said request; and

identifying one or more piece of music from said database in...

Claims: ...method of querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of their **features**, wherein said **features** comprise loudness, percussivity, tempo, pitch and sharpness, wherein each of the **features** of a piece of music is represented as a histogram describing the relative occurrence of each respective **feature** value across substantially the whole duration of said piece of music, the method comprising the steps of:a) obtaining a query (104) that contains the name of a piece of music and a degree of similarity, **specified** by a conditional expression, for the named piece; b) retrieving (1502) the **features**, according to which the piece of music named in the query (104) is indexed, from the database; c) comparing each of the **features** retrieved in the retrieving step and the corresponding **features** of the pieces of music in the database (308), comprising calculating, for each of the **features** , a histogram difference or a difference of a number of moments of each histogram; d) calculating a distance representing an overall degree of similarity between the named piece of music and the pieces of music in the database based on the calculated difference for each of the **features**; and e) identifying (314) pieces of music in the database based on the distance calculated in the calculating step as to satisfy the conditional expression... ...method of querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of their **features**, wherein said **features** comprise loudness, percussivity, tempo, pitch and sharpness, wherein each of the **features** of a piece of music is represented as a histogram describing the relative occurrence of each respective **feature** value across substantially the whole duration of said piece of music, the method comprising the steps of:a) obtaining a query (104) that contains at least one **feature** and a degree of similarity, **specified** by a conditional expression, for said at least one **feature** of the piece of music; b) comparing each of said at least one **feature** in the query and the corresponding **features** of the pieces of music in the database (308), comprising calculating, for each of the **features**, a histogram difference or a difference of a number of moments of each histogram; c) calculating a distance representing an overall degree of similarity between all of said **features** in the query and all of the **features** of pieces of music in the database (308) based on the calculated difference for each of the **features**; and d) identifying (314) pieces of music in the database based on the distance calculated in the calculating step as to satisfy the conditional expression contained in the query.

3. A method according to claim 1 or 2, wherein a **classification** according to which the pieces of music are indexed uses **feature** extraction, the method further comprising the steps of;segmenting (502) a piece of music over time into a plurality of windows;

extracting (402, 406, 410, 414) one or more **features** in each of said windows; and
arranging (1404) the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

4. A method according to clam 3, wherein a first **feature** extracted in the extracting step is at least one tempo (402) extracted from a digitised music signal, the **feature** extraction comprising the further sub-step of:segmenting (502) the music signal into a plurality of windows;

determining (504, 608) values indicative of the energy... ...6, wherein the onset signal is generated in generating sub-step according to the further sub-sub-steps of:sampling the energy signal;
comparing consecutive **samples** to determine a positive peak; and
generating a single pulse when each positive peak is detected.

9. A method according to any of claims 4... ...wherein the filter process resonant frequencies span a frequency range substantially between 1Hz and 4Hz.

10. A method according to claim 4, wherein a second **feature** extracted in the extracting step is a percussivity of a signal, the method comprising the sub-steps of:segmenting (710) the signal into a plurality... ...of the gradient.

11. A method according to claim 10, wherein the segmentation in the segmenting sub-step of the extracting step of the second **feature** comprises the further sub-steps of:selecting a window width (708);

selecting a window overlap extent (776); and
segmenting the signal into windows each window... ...for querying a music database (302), which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of their **features**, wherein said **features** comprise loudness, percussivity, tempo, pitch and sharpness, wherein each of the **features** of a piece of music is represented as a histogram describing the relative occurrence of each respective **feature** value across substantially the whole duration of said piece of music, the apparatus comprising:a) obtaining means for obtaining a query (104) that contains the name of a piece of music and a degree of similarity, **specified** by a conditional expression, for the named piece;
b) retrieving means for retrieving (1502) the **features**, according to which the piece of music named in the query (104) is indexed, from the database;
c) comparison means for comparing each of the **features** retrieved by the retrieving means and the corresponding **features** of the pieces of music in the database (308), said comparing comprising calculating, for each of the **features**, a histogram difference or a difference of a number of moments of each histogram;
d) calculating means for calculating a distance representing an overall degree of similarity between the named piece of music and the pieces of music in the database based on the calculated difference for each of the **features**; and
e) determination means (314) for identifying pieces of music in the database based on the distances calculated by the calculating means as to satisfy... ...for querying a music database (302), which contains

a plurality of pieces of music wherein the pieces are indexed according to a plurality of their **features**, wherein said **features** comprise loudness, percussivity, tempo, pitch and sharpness, wherein each of the **features** of a piece of music is represented as a histogram describing the relative occurrence of each respective **feature** value across substantially the whole duration of said piece of music, the apparatus comprising:a) obtaining means for obtaining a query (104) that contains at least one **feature** and a degree of similarity, **specified** by a conditional expression, for said at least one **feature** of the piece of music;
b) comparison means for comparing each of said at least one **feature** in the query and the corresponding **features** of the pieces of music in the database (308), said comparing comprising calculating, for each of the **features**, a histogram difference or a difference of a number of moments of each histogram;
c) calculating means for calculating a distance representing an overall degree of similarity between all of said **features** in the query and all of the **features** of pieces of music in the database (308) based on the calculated difference for each of the **features**; and
d) determination means (314) for identifying pieces of music in the database based on the distances calculated by the calculating means as to satisfy the conditional expression contained in the query.

14. An apparatus according to claim 12 or 13, wherein a **classification** according to which the pieces of music are indexed uses **feature** extraction means comprising;segmentation means (502) for segmenting an entire piece of music over time into a plurality of windows;

feature extracting means (402, 406, 410, 414) for extracting one or more **features** in each of said windows; and
histogram determination means for (1404) arranging the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

15. An apparatus according to claim 14, wherein a first **feature** extracted by said **feature** extraction means is at least one tempo extracted from a digitised music signal, and wherein the **feature** extraction means comprises:segmentation means (502) for segmenting the music signal into a plurality of windows;

energy determination means (504, 608) for determining values indicative... ...any of claims 15 to 17, wherein the onset signal generating means comprises:sampling means for sampling the energy signal;
comparator means for comparing consecutive **samples** to determine a positive peak; and
pulse generating means for generating a single pulse when each positive peak is detected.

20. An apparatus according to...

20/3,K/7 (Item 7 from file: 20)
DIALOG(R)File 20: Dialog Global Reporter

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11889666 **(USE FORMAT 7 OR 9 FOR FULLTEXT)**
Hitting the Right Notes

Music-recommendation sites figure out what kind of tunes you like, then suggest artists - both famous and obscure - that match your taste

Section Title: Technology
Compiler: Brad Stone
NEWSWEEK INTERNATIONAL
July 10, 2000
Journal Code: FNWI **Language:** English **Record Type:** FULLTEXT
Word Count: 885
(USE FORMAT 7 OR 9 FOR FULLTEXT)

...you goose bumps," says CEO John Adams, so he's hired two dozen music experts to evaluate songs and put them into subcategories within their **genre**, like "Rap **Metal**" and "HipHop Jazz" within rap, for instance. On the site, you pick among a graphical universe of 54 musical **types** such as **rock** or jazz, and weird **mood** categories like "evil" and "go girl!" Then you're asked to rate seven brief music clips. I went for the "stoned" category and took the...

...hadn't heard of, including Ian Brown and Tim Bluhm. Unfortunately, copyright law limits the clips to 30 seconds, which wasn't enough of a **sample** to judge whether I wanted to buy their CDs.

MoodLogic.com presents an interesting twist on the same idea, with CEO Tom Sulzer arguing that "music is **emotion**." Sulzer organized a thousand music lovers to rate the **mood** of various songs, and now visitors to the site are asked to respond in 10 categories about the **mood** of tunes they want to hear; in one search, I **specified** a "**happy**" song from the '70s, with a "very fast" tempo and a "light" beat. But I didn't bother to **specify** a **genre**, and the site came back with a 30-second clip from John Denver's "Grandma's Feather Bed." No thanks.

The other players in the...

...a more technology-centric approach. CantaMetrix, MongoMusic and Gigabeat all use varying forms of "digital signal analysis," which takes a song you like and evaluates **characteristics** such as beats per minute, then groups it with statistically similar tunes. Gigabeat is the farthest along in this approach. You can plug in any...

...re available to download - though I found many of the links to be broken.

One of the most promising approaches to music recommendations involves community-**driven** ratings. The idea here is closely related to collaborative filtering, a technology prominently used at Amazon.com to suggest products bought by folks whose buying...

...three-hour period, and it can't show you your playlist.

Overall, online music recommendations have a ways to go. But the technology is inspiring **heavy** buzz at gatherings like the MP3

Summit, held last week in San Diego. **Popular** sites like Napster and MP3.com, the thinking goes, are great for college kids who know what they want, but music sites will capture a...

20/3,K/2 (Item 2 from file: 20)
DIALOG(R)File 20: Dialog Global Reporter
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13334794 **(USE FORMAT 7 OR 9 FOR FULLTEXT)**
imix.com Signs Agreement with Yahoo! Shopping to Provide Customized Entertainment to Millions of Shoppers

BUSINESS WIRE
October 17, 2000
Journal Code: WBWE **Language:** English **Record Type:** FULLTEXT
Word Count: 950
(USE FORMAT 7 OR 9 FOR FULLTEXT)
...resource of online personalized entertainment, today announced an agreement with Yahoo! Inc. (Nasdaq:YHOO), a leading global Internet communications, commerce and media company, to be **featured** on Yahoo! Shopping (http://shopping.yahoo.com).
Recently ranked the No. 1 portal shopping destination by Neilsen//NetRatings (Aug. 2000), Yahoo! Shopping is utilizing imix...

...the option to make a customized music CD. The entire imix.com library of music, major artists and record label content, as well as additional **special** promotions, are being made available to consumers using Yahoo!. As part of the agreement, imix.com has fixed placement within the Music category of Yahoo! Shopping, featuring imix.com's CustomCD service. imix.com will also develop **special** promotions that will be **featured** in Yahoo! Shopping's Music category on an ongoing basis.
"The Yahoo! relationship also represents a continuation of our syndication strategy," Gould added. "Our goal...
...obtain personalized entertainment from imix.com.
"Yahoo! Shopping is dedicated to delivering the best products and services available to our large consumer audience, and the **type** of personalized entertainment experience that imix.com provides helps us fulfill that goal," said Rob Solomon, director of production, Yahoo! Shopping. "We are **happy** to work with imix.com and give consumers broad access to their innovative service."
Yahoo! Shopping is the only place consumers need to go to find, compare and buy almost anything online. Whether looking for personalized CDs, gifts for family or friends or the latest fashions, shoppers will find the **popular** merchants, brands and buying information they want on Yahoo!'s comprehensive Internet shopping destination. Consumers can shop for items from thousands of merchants in 20 retail categories, from trusted, brand name retailers. Yahoo! Shopping also has convenient **features**, such as Yahoo! Wallet and Express Checkout, that make online shopping fast and easy. Yahoo! Shopping is part of Yahoo!'s comprehensive suite of commerce...

...000 individual licensed tracks from more than 250 record labels. Customers who visit the Web site can search imix.com's extensive music library by **genre**, title, label, artist, or **mood**. imix.com also **offers** mix **suggestions** for holidays and **special** occasions. Additionally, there is a selection of secure digital downloads and free music found on the company's Web site (www.imix.com).
In conjunction...

23/3,K/1 (Item 1 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0013900427 *Drawing available*
WPI Acc no: 2004-079813/200408
XRPX Acc No: N2004-063750
Query creation method for use in musical content search, involves receiving selection criteria identifying portion of structural representation of musical content and creating query profile from identified portion
Patent Assignee: INT BUSINESS MACHINES CORP (IBMC)
Inventor: KRAFT R; LU Q; TENG S

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
US 6674452	B1	20040106	US 2000543218	A	20000405	200408	B

Priority Applications (no., kind, date): US 2000543218 A 20000405

Patent Details					
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**
US 6674452	B1	EN	17	10	

Original Publication Data by AuthorityArgentina**Publication No.** ...**Original Abstracts:**existing piece of music, or some components thereof, as query arguments, and lets the music search engine find music that is similar to the given **sample** by certain similarity **measurement. >...Claims:of the first musical piece in the form of a component graph that displays parts and measure components of the first musical piece;(d) receiving selection criteria identifying at least a portion of the structural representation of the first musical piece; and(e) creating a query profile from the identified portion of the structural representation of the first musical piece.**

Dialog eLink: Order File History

23/3,K/2 (Item 2 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0012950404 *Drawing available*
WPI Acc no: 2003-027267/200302
System and method for searching for music data based on contents
Patent Assignee: ELECTRONICS&TELECOM RES INST (ETRI)
Inventor: CHUN Y S; KIM H N; MUN B R; SON S U

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
KR 2002053979	A	20020706	KR 200082255	A	20001226	200302	B

Priority Applications (no., kind, date): KR 200082255 A 20001226

Patent Details					
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**
KR 2002053979	A	KO	1	10	

Alerting Abstract ...comprises a client web server(10), a contents based music information retrieval server(20), a web server(21), a CGI(Common Gateway Interface, 22), a **melody** transcription module(23), a **search** criteria module(24), an HTML formatter(25), a music retrieval module(26), a **music search** module(27), and a **music database** (28). The music **database**(28) stores or manages the music data. The **web** server(21) and the CGI(22) receive audio **samples** and search instructions from the client **web** server(10) and offer the search result to the client **web** server(10). Also, the **web** server(21) receives music retrieval instructions from the client **web** server(10) and offers the retrieval result to the client **web** server(10). The melody transcription module(23) analyzes the audio **sample** transmitted via the CGI(22), and generates the corresponding **musical** note. The **search** criteria module(24) analyzes the search instructions and sets **search** criteria and conditions. The **music** retrieval module(27) retrieves from the music **database** (28) the music data including the musical note, generated by the melody transcription module(23), according to the **search** criteria and conditions. The **music search** module(26) **searches** the **music database** for a music title, and transmits the music title to the **web** server(21) via the CGI(22).

Dialog eLink: Order File History

23/3,K/3 (Item 3 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0010902193 *Drawing available*
WPI Acc no: 2001-523052/200158
Related WPI Acc No: 2000-224113; 2001-603816; 2002-338007; 2002-469860; 2003-016027; 2005-178917; 2005-743509; 2006-086186; 2006-314711; 2006-328117; 2006-723662
XRPX Acc No: N2002-062036

Unique identification method for digital content on digital content player, by receiving first, second and third identifiers, and producing fourth unique identifier based on mathematical combination of identifiers

Patent Assignee: IBM CORP (IBMC); INT BUSINESS MACHINES CORP (IBMC); WISTRON CORP (WIST-N)
Inventor: DORACK J J; DORAK J J

Patent Family (12 patents, 30 countries)

Patent Number	Kind	Date	Application Number	Kind	Date	Update	Type
CN 1289100	A	20010328	CN 2000127012	A	20000914	200158	B
EP 1085443	A2	20010321	EP 2000308024	A	20000914	200212	ETAB
CA 2316762	A1	20010317	CA 2316762	A	20000817	200159	E
JP 2001160003	A	20010612	JP 2000279877	A	20000914	200159	E
KR 2001050381	A	20010615	KR 200053161	A	20000907	200171	E
US 6389403	B1	20020514	US 1998133519	A	19980813	200239	E
			US 1998177096	A	19981022		
			US 1999397419	A	19990917		
KR 444695	B	20040818	KR 200053161	A	20000907	200481	E
CA 2316762	C	20070403	CA 2316762	A	20000817	200726	E
CN 100345157	C	20071024				200830	E
EP 1085443	B1	20080827	EP 2000308024	A	20000914	200858	E
DE 60040041	E	20081009	DE 60040041	A	20000914	200868	E
			EP 2000308024	A	20000914		
JP 4347508	B2	20091021	JP 2000279877	A	20000914	200970	E

Priority Applications (no., kind, date): US 1998133519 A 19980813; US 1998177096 A 19981022; US 1999397419 A 19990917

Regional Designated States,Original	AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI

Patent Details

Patent Number	Kind	Lan	Pgs	Draw	Filing Notes	
US 6389403	B1	EN		18	C-I-P of application	US 1998133519
CN 1289100	A	ZH			C-I-P of application	US 1998177096
CA 2316762	A1	EN			C-I-P of patent	US 6226618
JP 2001160003	A	JA	82		Previously issued patent	KR 2001050381
KR 444695	B	KO				
EP 1085443	A2	EN	97	18		
CA 2316762	C	EN				

EP 1085443	B1	EN				
Regional Designated States,Original	AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE					
DE 60040041	E	DE			Application	EP 2000308024
					Based on OPI patent	EP 1085443
JP 4347508	B2	JA	107		Previously issued patent	JP 2001160003

Original Publication Data by AuthorityArgentina**Publication No.** ...**Original Abstracts:**object of the conventional store, i.e., a non-electron, and non-online uses product sales promotion, product sales, a product **sample**, a generous returned-goods plan, and other sales promotion programs, Itself is differentiated from a competitor.However, in the on-line world where a content...specific encoding algorithm and specific bit rate.When the rate coefficient calculated before is not memorize|stored, only the time of predetermined length encodes the **sample** of the content 113.The predetermined time period of preferable embodiment is 2 to 3 seconds.The ratio of an encoding of this predetermined time...invention, and the meaning.The data (For example, the genre relevant to the list|wrist, this artist, or product of the album in which the **sample** clip by this artist, this artist's passage|experience, and this recording are included in the case of a music) which the content provider 101... ...an end user, The content provider 101 can identify Type (For example, the genre relevant to the list|wrist of the album in which the **sample** clip by this artist, this artist's passage|experience, and this recording are included in a musical example, and this artist) of the sales promotion... ...end user apparatus 109 requires, the data field which can be supplied to the end user apparatus 109 as option, And the group of the **sample** of the data field which makes the electronic digital content store 103 object which accelerates|stimulates an artist, an album, or a single sale is... AC3, ATRAC (trademark)) and a compression level.In order to achieve compression of a higher level, before passing a compression algorithm, data are usually re-**sampled** with a low sampling rate.In order to enable efficient compression rather than there are few loss|disappearances of fidelity, or in order to prevent... ...than the downloadable audio file for sale also has the clip by which the LBR encoding was carried out, in order to be able to **sample** music via the low bit-rate (LBR) streaming protocol.This LBR encoding is also the responsibility for the content processing tool 155.This clip is...audio file produced during the audio processing regarding various quality levels of perfect music packs to separate content SC630.The audio file produced for the **sample** clip is passed as a metadata file, and is included in metadata SC620.F. Last quality assurance toolThe last quality assurance tool gives a user...content store 103, and the end user web browser 191 of the end user apparatus 109.The preview of the digital content clip of a **sample** is included in this.As for a digital content clip, packaging is not carried out to SC, However, Instead, the web service of the electronic...wrist object- Music list display container, othersA container, others- Player window container- Audio control container- Metadata control container- Metadata display container- Tool bar container object- **Sample** button- Download button- Purchasing button- Recording button- Player name object- Label / provider / store advertisement object- Label / provider / store URL button- Artist URL button, others3. Copy... ...on actual use, a user's identification, and the frequency|count by which content 113 was performed.By the measurement of actual use, this system **samples** only limited numbers, such as the Nielsen Index system or a telephone poll of a television, of users at 1:00, It becomes a fact...list is preserve| saved to the digital content library 196.- Deletion of music- The music selected now is deleted from a reproduction list.- Addition of **music**- It calls in **music search** mode for selection of the music

which a digital content librarian adds to a reproduction list.For **details**, please also refer a younger digital content librarian's item.- Setting of music information- The information regarding the music selected within the reproduction list is **displayed**, and the change with respect to the information is enabled.The information regarding the music which this information was stored in the reproduction list and stored in the digital content library 196 is not changed.The following items can be changed.- Title of music **displayed**- Memo of end user regarding music- Lead-in delay at the time of music reproduction|regeneration- Followone|on delay after music reproduction|regeneration- Starting point... ...of reproduction|regeneration- Ending point in music at the time of reproduction|regeneration- Weighting for random modes- volume control and others of this musicReproduction-list **attribute** setting: The **attribute** of this reproduction list is **displayed** and the change with respect to it is enabled.The following **attributes** can be set.- Title of reproduction list- Mode of reproduction list (random, sequential, in addition to this)- Repeat mode (at the time of completion|finish 1-time reproduction|regeneration, restart, in addition to this)- memo of end user regarding this reproduction listLibrarian (Corresponding|compatible on **Screen** 1601 of an end user **interface**) and a digital content librarian window are opened.For **details**, please also refer a younger digital content librarian's item.A reproduction|regeneration of musicBy either of selecting the music which is depended on calling... ...digital content librarian, When the music for a reproduction|regeneration is ready, the option of an end user is as follows (It respond|corresponds to **Screen** 1601 of an end user **interface**.).- Reproduction|regeneration- Pause- Stop- It skips back.- It skips to front.- Volume control- Track|truck position adjusting- Lyric **display**- Credit **display**- CD cover **display**- Artist picture **display**- Presenting of track|truck information- **Display** of **other** metadata- **Website** visit- Reproduction list- Librarian, othersthe inside of implicitness when a digital content librarian digital content librarian selects music or a reproduction list -- calling (refer the... ...identifier intrinsic|native to the content processed.Transaction ID535 are some transaction data 642 in content ID1802 within the transaction SC640 produced with the transaction **processor** module 175, as demonstrated above in the top.Transaction ID535 is an identifier intrinsic|native to each of the whole purchasing transaction from the end ...system which identifies use of digital content on user apparatus, Comprising:They are several content sites which distribute digital content to a user on a **computer**-readable medium, Comprising:The said digital content is several content sites containing the unique content identifier link|related with it, and several cyberstores which give...said digital contentThe digital content player which contains these further and which identifies uniquely the digital content as described in said (10).(15) It is **computer**-readable medium including program command which identifies digital content uniquely on digital content player, Comprising:The program command which receives the 1st identifier which identifies... ...The program command which receives the 3rd identifier which identifies uniquely the item in the transaction which received the said digital content by it, The **computer**-readable medium which includes the program command which makes a 4th unique identifier based on the mathematical combination of the above-mentioned 1st identifier, the above-mentioned 2nd identifier, and the above-mentioned 3rd identifier.(16) The **computer**-readable medium as described in said (15) including that the said program command to make makes a 4th unique identifier based on connection of the above-mentioned 1st identifier, the above-mentioned 2nd identifier, and the above-mentioned 3rd identifier.(17) The **computer**-readable medium as described in said (15) in which the program command which receives the above-mentioned 2nd identifier includes receiving the identifier unique from... ...store which sells the said digital content.(18) Program command which receives the above-mentioned 3rd identifier from store which sells said digital content, The **computer**-readable medium as described in said (17) including receiving the unique identifier from which the said digital content identifies uniquely the transaction received by it.(19) Program command which link|relates above-mentioned 4th unique identifier with said digital content

including service condition, The **computer**-readable medium as described in said (15) which includes further the program command which re-evaluates the said service condition by carrying out indexing of the above-mentioned 4th unique identifier before reproduce|regenerating the said digital content.(20) The **computer**-readable medium as described in said (15) which includes making the above-mentioned 4th unique identifier in a tamper-proof environment in order that the... ...8 and which shows the outline|summary of content distribution and license grant control.It is a figure by this invention which shows the user **interface** of the **example** of the workflow manager tool of FIG. 1 thru|or 4.They are the main tools of the workflow manager corresponding to the user **interface** of FIG. 10 by this invention, a component, and a block diagram of a processing.It is the main tools of the electronic digital content... ...of the automatic metadata acquisition tool of FIG. 11 by this invention.It is a flowchart of the method of setting automatically the pre-processing **parameter** and compression **parameter** of the pre-processing of FIG. 11 by this invention, and a compression utility.It is a figure by this invention which downloads content to a local library like FIG. 18 and FIG. 19 and which shows the **example** of the user **interface screen** of a player application.It is a block diagram which shows the components and processings with a main player application by this invention in which **interface screen** of the **example** of the **player** application of FIG. 18 and FIG. 19.It is a flowchart of alternative embodiment for pick... ... acquisition processing804 Manual metadata input processing805 Service-condition processing806 Monitoring publication|presentation processing807 Metadata SC preparation processing808 Watermarking processing809 Pre-processing and compression processing810 Content **quality** control processing811 Encryption processing812 Content SC preparation processing813 Last **quality** assurance processing814 Content distributed processing...

10/3,K/18 (Item 1 from file: 813)
DIALOG(R)File 813: PR Newswire
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1216068 NYF087
EMI Music Publishing Launches Advanced Online Lyric Catalogue

Date: January 23, 1998 11:46 EST **Word Count:** 584

Correction:
...to, and soundclips from, thousands of songs from EMI's rich and varied collection of songs.

The lyric catalogue is completely user-friendly. Researchers simply **type** the word(s) that best describe the **mood** or idea they are looking for. Next, the search engine reads all the lyrics of every song in EMI's vast online database. At the end of each list of matching **songs**, the **search** will also offer additional synonyms from its internal thesaurus that **offers** an even greater **selection** of descriptive **terms** for searching.

The lyric search engine, which is part of the overall EMI site designed and created by Gary Klein, Senior Vice President Creative Services...

II. Inventor Search

A. Dialog

File 348:EUROPEAN PATENTS 1978-201021
(c) 2010 European Patent Office
File 349:PCT FULLTEXT 1979-2010/UB=20100527|UT=20100520
(c) 2010 WIPO/Thomson
File 635:Business Dateline(R) 1985-2010/Jun 03
(c) 2010 ProQuest Info&Learning
File 570:Gale Group MARS(R) 1984-2010/Apr 29
(c) 2010 Gale/Cengage
File 47:Gale Group Magazine DB(TM) 1959-2010/May 11
(c) 2010 Gale/Cengage
File 15:ABI/Inform(R) 1971-2010/Jun 02
(c) 2010 ProQuest Info&Learning
File 9:Business & Industry(R) Jul/1994-2010/Jun 02
(c) 2010 Gale/Cengage
File 610:Business Wire 1999-2010/Jun 03
(c) 2010 Business Wire.
File 810:Business Wire 1986-1999/Feb 28
(c) 1999 Business Wire
File 275:Gale Group Computer DB(TM) 1983-2010/Apr 23
(c) 2010 Gale/Cengage
File 624:McGraw-Hill Publications 1985-2010/Jun 03
(c) 2010 McGraw-Hill Co. Inc
File 621:Gale Group New Prod.Annou.(R) 1985-2010/Apr 14
(c) 2010 Gale/Cengage
File 636:Gale Group Newsletter DB(TM) 1987-2010/Jun 03
(c) 2010 Gale/Cengage
File 613:PR Newswire 1999-2010/Jun 03
(c) 2010 PR Newswire Association Inc
File 813:PR Newswire 1987-1999/Apr 30
(c) 1999 PR Newswire Association Inc
File 16:Gale Group PROMT(R) 1990-2010/Jun 03
(c) 2010 Gale/Cengage
File 160:Gale Group PROMT(R) 1972-1989
(c) 1999 The Gale Group
File 634:San Jose Mercury Jun 1985-2010/Jun 02
(c) 2010 San Jose Mercury News
File 148:Gale Group Trade & Industry DB 1976-2010/Jun 03

(c) 2010 Gale/Cengage
File 20:Dialog Global Reporter 1997-2010/Jun 03
(c) 2010 Dialog
File 35:Dissertation Abs Online 1861-2010/Apr
(c) 2010 ProQuest Info&Learning
File 583:Gale Group Globalbase(TM) 1986-2002/Dec 13
(c) 2002 Gale/Cengage
File 65:Inside Conferences 1993-2010/Jun 03
(c) 2010 BLDSC all rts. reserv.
File 2:INSPEC 1898-2010/May W3
(c) 2010 The IET
File 474:New York Times Abs 1969-2010/Jun 03
(c) 2010 The New York Times
File 475:Wall Street Journal Abs 1973-2010/Jun 03
(c) 2010 The New York Times
File 99:Wilson Appl. Sci & Tech Abs 1983-2010/Mar
(c) 2010 The HW Wilson Co.
File 256:TecTrends 1982-2010/May W5
(c) 2010 Info.Sources Inc. All rights res.
File 8:Ei Compendex(R) 1884-2010/May W4
(c) 2010 Elsevier Eng. Info. Inc.
File 6:NTIS 1964-2010/Jun W1
(c) 2010 NTIS, Intl Cpyrght All Rights Res
File 34:SciSearch(R) Cited Ref Sci 1990-2010/May W4
(c) 2010 The Thomson Corp
File 434:SciSearch(R) Cited Ref Sci 1974-1989/Dec
(c) 2006 The Thomson Corp
File 7:Social SciSearch(R) 1972-2010/May W5
(c) 2010 The Thomson Corp
File 347:JAPIO Dec 1976-2010/Jan(Updated 100427)
(c) 2010 JPO & JAPIO
File 350:Derwent WPIX 1963-2010/UD=201034
(c) 2010 Thomson Reuters

```
Set     Items   Description
S1       3452   AU=(KHAN, R?  OR MATHYS, M?   OR PIRKNER, C?  OR SULZER, T OR KHAN
R?  OR MATHYS M?   OR PIRKNER C?  OR SULZER T)

S2         12   S1 AND MUSIC?
S3          9   S2 FROM 347,348,350,349
S4          9   IDPAT S3 (sorted in duplicate/non-duplicate order)
S5          8   IDPAT S3 (primary/non-duplicate records only)
```

```
S6          3   S2 NOT S3
S7          3   RD  (unique items)
```

File 387:The Denver Post 1994-2010/Jun 03
(c) 2010 Denver Post
File 471:New York Times Fulltext 1980-2010/Jun 04
(c) 2010 The New York Times
File 492:Arizona Repub/Phoenix Gaz 19862002/Jan 06
(c) 2002 Phoenix Newspapers
File 494:St LouisPost-Dispatch 1988-2010/May 30
(c) 2010 St Louis Post-Dispatch
File 631:Boston Globe 1980-2009/Dec 30
(c) 2010 Boston Globe
File 633:Phil.Inquirer 1983-2010/Jun 04
(c) 2010 Philadelphia Newspapers Inc
File 638:Newsday/New York Newsday 1987-2010/Jun 04
(c) 2010 Newsday Inc.
File 640:San Francisco Chronicle 1988-2010/Jun 04
(c) 2010 Chronicle Publ. Co.
File 641:Rocky Mountain News Jun 1989-2009/Jan 16
(c) 2009 Scripps Howard News
File 702:Miami Herald 1983-2010/Jun 04
(c) 2010 The Miami Herald Publishing Co.
File 703:USA Today 1989-2010/Jun 03
(c) 2010 USA Today
File 704:(Portland)The Oregonian 1989-2010/Jun 03
(c) 2010 The Oregonian
File 713:Atlanta J/Const. 1989-2010/Jun 04
(c) 2010 Atlanta Newspapers
File 714:(Baltimore) The Sun 1990-2010/Jun 04
(c) 2010 Baltimore Sun
File 715:Christian Sci.Mon. 1989-2009/Dec 07
(c) 2009 Christian Science Monitor
File 725:(Cleveland)Plain Dealer Aug 1991-2010/Jun 03
(c) 2010 The Plain Dealer
File 735:St. Petersburg Times 1989- 2010/May 05
(c) 2010 St. Petersburg Times
File 477:Irish Times 1999-2010/Jun 04

(c) 2010 Irish Times
File 710:Times/Sun.Times(London) Jun 1988-2010/Jun 04
(c) 2010 Times Newspapers
File 711:Independent(London) Sep 1988-2006/Dec 12
(c) 2006 Newspaper Publ. PLC
File 756:Daily/Sunday Telegraph 2000-2010/Jun 04
(c) 2010 Telegraph Group
File 757:Mirror Publications/Independent Newspapers 2000-2010/Jun 04
(c) 2010

```
Set     Items   Description
S1          0   AU=(KHAN, R?  OR MATHYS, M?   OR PIRKNER, C?  OR SULZER, T OR KHAN
R?  OR MATHYS M?   OR PIRKNER C?  OR SULZER T)
```

Dialog eLink: Order File History

5/3/3 (Item 3 from file: 350)
DIALOG(R)File 350: Derwent WPIX
(c) 2010 Thomson Reuters. All rights reserved.

0017195932 *Drawing available*
WPI Acc no: 2008-A16366/200801
Related WPI Acc No: 2007-725300
XRPX Acc No: N2008-012907
Audio waveform fingerprint generating method for use in computer, involves generating fingerprint by representing audio wave-form with string of codes from codebook, and aligning string of codes in time series
Patent Assignee: MOODLOGIC INC (MOOD-N)
Inventor: **KHAN** R M; TZANETAKIS G

Patent Family (1 patents, 1 countries)

Patent Number	Kind	Date	Application Number	Kind	Date	Update	Type
US 20070282935	A1	20071206	US 2000695457	A	20001024	200801	B
			US 2007839768	A	20070816		

Priority Applications (no., kind, date): US 2000695457 A 20001024; US 2007839768 A 20070816

Patent Details						
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**	
US 20070282935	A1	EN	18	10	Continuation of application	US 2000695457
					Continuation of patent	US 7277766

Dialog eLink: Order File History

5/3/4 (Item 4 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0017010239 *Drawing available*
WPI Acc no: 2007-725300/200768
Related WPI Acc No: 2008-A16366
XRPX Acc No: N2007-571683
Audio waveform fingerprinting apparatus, has memory to store codebook and processor to divide audio waveform into multiple bins, where processor generated fingerprint representing audio waveform with string of codes for each bin
Patent Assignee: MOODLOGIC INC (MOOD-N)
Inventor: **KHAN** R M; TZANETAKIS G

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
US 7277766	B1	20071002	US 2000695457	A	20001024	200768	B

Priority Applications (no., kind, date): US 2000695457 A 20001024

Patent Details					
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**
US 7277766	B1	EN	16	10	

Dialog eLink: Order File History

5/3/7 (Item 7 from file: 350)
DIALOG(R)File 350: Derwent WPIX

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0013462290 *Drawing available*
WPI Acc no: 2003-553794/200352
XRPX Acc No: N2003-439628
Music database creating method e.g. for use in dance party, involves assigning response of listeners for questions with respect to music samples, as feature vectors which are compared, so as to compare music samples
Patent Assignee: MOOD LOGIC INC (MOOD-N)
Inventor: GJERDINGEN R O; **KHAN R M**; **MATHYS M**; **PIRKNER C D**; RICE P W; SULZER T R

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
US 6539395	B1	20030325	US 2000533045	A	20000322	200352	B

Priority Applications (no., kind, date): US 2000533045 A 20000322

Patent Details					
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**
US 6539395	B1	EN	44	13	

Dialog eLink: Order File History

5/3/8 (Item 8 from file: 350)
DIALOG(R)File 350: Derwent WPIX
(c) 2010 Thomson Reuters. All rights reserved.

0011191806 *Drawing available*
WPI Acc no: 2002-130000/200217
XRPX Acc No: N2002-098052
Internet based music searching system searches music based upon music content described by predetermined feature vectors relating to multiple user desired music characteristics
Patent Assignee: GJERDINGEN R O (GJER-I); KHAN R M (KHAN-I); MATHYS M (MATH-I); PIRKNER C D (PIRK-I); RICE P W (RICE-I); SULZER T R (SULZ-I)
Inventor: GJERDINGEN R O; **KHAN R M**; **MATHYS M**; **PIRKNER C D**; RICE P W; SULZER T R

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
US 20020002899	A1	20020110	US 2000532196	A	20000322	200217	B

Priority Applications (no., kind, date): US 2000532196 A 20000322

Patent Details					
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**
US 20020002899	A1	EN	50	13	

7/3,K/2 (Item 1 from file: 15)
DIALOG(R)File 15: ABI/Inform(R)
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02852107 774833711
Role and Relevance of Web Supported Learning for First Generation Learners

Sherif, Jazeela; **Khan, Rehan**
Journal of American Academy of Business, Cambridge v6n1 pp: 123-129
Mar 2005
Journal Code: JAAB
Word Count: 5532
...**Khan, Rehan**
Text:
...low network speed and busy computers at peak times which is partially attributed to the extensive downloading of huge files of movies, cards, pictures and **music** by the students themselves. This, however, should not be a deterrent in providing Internet facilities of superior quality. On the other hand it is advisable...

?

III. Text Search Results from Dialog (Full Text dbs)

A. Full-Text Databases – PATENT

File 348:EUROPEAN PATENTS 1978-200950
(c) 2009 European Patent Office
File 349:PCT FULLTEXT 1979-2009/UB=20091210|UT=20091203
(c) 2009 WIPO/Thomson

```
Set     Items   Description
S1      23284   (MUSIC? OR MELODY OR SONG OR SONGS OR SINGING OR
PERFORMANCE(5N)(MUSIC?
 OR BAND OR ORCHESTR?) OR ORCHESTRA? OR BANDS)(4N)(SEARCH? OR QUER? OR REQUEST? OR
 INQUIR? OR USER(2N)INPUT?)

S2      13723   (INTERFACE? OR SCREEN? ? OR MONITOR? ? OR COMPUTER? OR NETWORK ? OR
WEB?  OR ONLINE OR DATABASE? OR DATASYSTEM? OR PROCESSOR? OR ENGINE? ? OR GUI OR
DISPLAY? OR  CRT? ? OR CATHODE()RAY OR OUTPUT? OR WORKSTATION? OR KEYBOARD? OR PC
OR (KNOWLEDGE OR  DATA)()BASE?  )

S3   31099604   ATTRIBUTE? OR FEATURE? OR QUALIT? OR CHARACTERISTIC? OR PARAMET? OR
TERMS OR NATURE OR VECTOR? OR SPEC? OR DETAIL?

S4   18583227   GENRE? OR TYPE? OR ROCK OR R(2W)B OR BLUES OR RHYTHM(2W)BLUES OR
STYLE?  OR CLASSICAL OR MODERN OR PROG OR PROGRESSIVE OR METAL OR HEAVY OR
INSTRUMENTALS OR  POPULAR OR ALTERNATIVE(2W)(MUSIC? OR ROCK) OR INDY OR INDIE OR
DRIVEN OR POP OR  CLASSIFICATION? OR TAXONOM? OR TYPOLOGY

S5   10154387   EMOTION? OR MOOD? OR HAPPY OR SAD OR DARK OR RHYTHM(2N)TYPE OR
INTENSE OR LOUD OR MELLOW OR RAUCOUS OR SAD OR AGGRESSIVE OR UPBEAT OR DOWNCAST OR
ROWD? OR  ROMANTIC OR SWEET OR DRIVING OR DANCEABLE

S6       5196   (SELECTION? OR EXAMPLE? OR PROMOTIONAL OR SUGGESTION? OR SIMILAR OR
 ALTERNAT? OR RELATED OR OTHER OR SUPPLEMENT? OR LIKE OR COMMON OR SELECT) (3N)
(OFFER? OR PRESENT? OR SUGGEST? OR DISPLAY? OR GUI ? ? OR BRING?()UP OR INTERFACE?
OR SPEAKER? ?  OR HEADPHONE? OR HEAD()PHONE? OR EAR()PHONE? OR EARPHONE? OR PLAY?)
OR SAMPLE? OR SONGSELECTION? OR EXCERPT?

S7       3000   S3 AND S4 AND S5
S8       1293   S6(S)S1
S9        380   S8 AND S7
S10       258   S9 FROM 348,349
S11        57   S10 NOT AY>2000
S12        30   S11 AND SAMPLE?
S13        27   S11 NOT S12
```

17/3K/1 (Item 1 from file: 348)
01624354

Recording method of recording medium
Aufzeichnungsverfahren fur Aufzeichnungsmedium
Procede d'enregistrement de milieu d'enregistrement

Patent Assignee:

- **SONY CORPORATION** (214025)
  6-7-35 Kitashinagawa Shinagawa-ku; Tokyo 141 (JP)
  (Applicant designated States: all)

Inventor:

- **Yokota, Teppei, c/o Sony Corporation**
  6-7-35 Kitashinagawa, Shinagawa-ku; Tokyo 141; (JP)
- **Aramaki, Junichi, c/o Sony Corporation**
  6-7-35 Kitashinagawa, Shinagawa-ku; Tokyo 141; (JP)
- **Kihara, Nobuyuki, c/o Sony Corporation**
  6-7-35 Kitashinagawa, Shinagawa-ku; Tokyo 141; (JP)

Legal Representative:

- **Pratt, Richard Wilson et al (46458)**
  D Young & Co 120 Holborn; London EC1N 2DY; (GB)

	Country	Number	Kind	Date	
Patent	EP	1339062	A2	20030827	(Basic)
Patent	EP	1339062	A3	20051109	
Application	EP	2003076380		19940104	
Priorities	JP	9315887		19930106	
	JP	9315888		19930106	
	JP	9350188		19930216	

Designated States:
DE; FR; GB

Related Parent Numbers: Patent (Application):EP 833338 (EP 97203635)

International Patent Class (V7): G11B-027/034; G11B-027/22; G11B-027/30; G11B-007/28; G11B-011/105**Abstract Word Count:** 258
NOTE: Figure number on first page: NONE
Language Publication: English

Procedural: English

Application: English

Fulltext Availability Available Text	Language	Update	Word Count
CLAIMS A	(English)	200335	255
SPEC A	(English)	200335	14268
Total Word Count (Document A) 14523			
Total Word Count (Document B) 0			
Total Word Count (All Documents) 14523			

Specification: ...for recording digital signals supplied with an additional information to a recording medium.

There are magneto-optical discs as data rewritable recording mediums of disc **type** which can record digital data such as computer data. While data is recorded in the magneto-optical disc, a recording film of the magneto-optical... ...105" into sub-areas which are respectively assigned the remaining sound groups.

Therefore, in the recording/reproducing unit using a magneto-optical disc of this **type**, sound groups are formed by processing a volume compression on sequentially input audio data. The sound groups thus formed into sectors are further formed into...as to be recorded in second part P2 and fourth part P4.

In such a case, when the start address of musical composition 5 is **specified** with a pointer, the performance start position of the second part P2 is detected by the start address, and furthermore, the recording end position of... ...the start address.

Moreover, in the magneto-optical disc, a start address is detected when a link pointer (Link-P) following this end address is **specified** similarly to the pointers (P-FRA, P-TNO1, ..., P-TNO255) of fourth part P4. Thus, the magneto-optical disc can record audio data by the... ...P-TNO1, ..., P-TNO255) are formed in correspondence to the respective audio data recorded on the magneto-optical disc, and the corresponding parts P are **specified** respectively together with link pointers.

In contrast, when musical composition 2 has been erased from the audio data recorded continuously, the magneto-optical disc recording... musical compositions recorded in the magneto-optical disc can be easily performed.

However, there are proper cases where a user reproduces a desired track by **searching** for **musical** compositions which are recorded in a disc of a compact disc **player**, for **example**, that is, a search operation (access operation) for performing program reproduction so as to play musical compositions in a desired order is carried out during...inputted digital signals. When it is detected that the audio data is not included in the inputted digital signals, the waiting state for recording the **specific** time is set. In the case where it is detected that the reproduction passage time information becomes not to change and the audio data is not included in the inputted digital signals after passing the **specific** time, the recording operation of data to the recording medium terminates. Moreover, the time, that the **specific** time has past from the time of which the reproduction passage time information becomes not to change and the end

point of the inputted digital... ...supplied with the inputted digital signals. It is detected that the index data is the last index data, thereafter, the waiting state for recording the **specific** time is set. After passing the **specific** time, the recording operation of data to the recording medium terminates. Moreover, the time, that the **specific** time has past from the time of which it is detected that the index data is the last index data, is recorded as a recording... ...of the recording medium. The observation of the additional information which is supplied with the inputted digital signals is started from the time that the **specific** time has past after the recording start point is set. It is detected whether the inputted digital signal is (N+1)-th signal or not... ...the recording operation to the recording medium is stopped at the time of detection of which the signal level of the inputted analog signals, during **specific** period from the time of detection of which the detected signal level of the analog signal becomes lower than the **specific** signal level.

According to an embodiment of this invention, the change point of audio data is detected by using, at least, one of the additional...terminate the recording operation without user's operation of unit, and further, enables to record in the recording medium without a waste mute portion.

The **nature**, principle and utility of the invention will become more apparent from the following **detailed** description when read in conjunction with the accompanying drawings in which like parts are designated by like reference numerals or characters.

In the accompanying drawings... ...twenty three hundred and thirty two (byte) of one sector is for data. One sound group is 424 (byte). Moreover, one sound group is 512 **samples** of audio signals which are ...one of the aperture portion of the disc cartridge of the magneto-optical disc 1. The optical pick up 3 includes an actuator 4 for **driving** the object lens 3a toward the focusing and tracking direction. The actuator 4 consists of electromagnetic actuators, and focusing servo signals and tracking servo signals are supplied from a servo control circuit 17. As a result, the object lens 3a is **driven** to the focusing direction and the tracking direction in order that the focusing error signals and tracking error signals become to "0" respectively, and in... ...pick up 3 to the direction of diameter of the magneto-optical disc 1, and a feed mechanism unit having a motor for generating the **driving** power to feed the optical pick up 3 to the direction of diameter of the magneto-optical disc 1. The feed mechanism 5 feeds the ... ...up 3 across the magneto-optical disc 1. The magnetic head 6 generates the vertical magnetic field corresponding to the recording data based on the **driving** signals supplied from a magnetic head **driving** circuit 14. The generated vertical magnetic field is supplied to the recording film from the protection film side of the magneto-optical disc 1. The...reading of data in the memory 12 in order to reduce the data stored thereof, while the correct recording operation is performed in recording. More **specifically**, if the data size in the memory 12 exceeds the predetermined size, the data of **specific** size, for example the data for one cluster, is read from the memory 12 so as to keep the storable area having the data size ... ...is used for the code for error detection correcting.

The recording data outputted from the second encoder/decoder 13 is supplied to a magnetic head **driving** circuit 14. The magnetic head **driving** circuit 14 generates the **driving** signals for the magnetic head 6 based on the recording data, and supplies the **driving** signals to the magnetic head 6.

The output signals from the light detector of the optical pick up 3 is supplied to a RF amplifier...information INDEX: "01" to "99" indicative of "under reproduction," "00" indicative of "pausing," and "FF" indicative of "reproduction being stopping."

As will be described in **detail** later, system controller 18 uses index information INDEX and intra-composition lapse information (MIN, SEC, FRAME) of such Q data.

Moreover, apart from such Q... ...recordable areas and recorded areas, the management data being rewritten as data is recorded or erased so that recording can always be started from a **specified** recordable ...second encoder/decoder 10, which is then converted into the recording data. The recording data is supplied to the magnetic head 6 via the head **driving** circuit 14. The magnetic head 6 supplies the vertical magnetic field modulated by the **driving** signal in accordance with the recording data to the magneto-optical disc 1. At this time, the light beam having the necessary output level to...data in all the memory 12 is 0.9 (sec), and this digital data is corresponding to the analog signal of about three (sec). More **specifically**, when the digital data is fully stored in the memory 12, if the output signal is not supplied, due to the vibration, etc., from the...compositions, that is, digital signal, being recorded, begins at the time when the user starts the recording operation with the input part 19 (SP106). More **specifically**, the operation to update the track number at the time when the recording of digital signal corresponding to a musical composition ends and the recording... ...track number is given can be considered to be fairly short. Therefore, it is desired that the waiting time is changed in accordance with the **type** of digital data to be recorded.

Whether or not the flag FCD)) or flag FMD)) is turned on is checked after the waiting time passes...recording through judgment of the end of a supply of audio signals from signal source if the mute interval has continued for at least a **specified** length of time, in as much as analog input signals lack control data, such as sub-codes. The automation of a recording stop process will...Subsequently, the system controller 18 proceeds to step SP25, thereon starts monitoring control data sent from the compact disc player after the lapse of a **specified** duration and thus starts detecting the top of a subsequent musical composition at step SP26 before proceeding to step SP27.

The system controller 18 then starts monitoring control data after the lapse of a **specified** duration so as not to mistake a mute period immediately following the start of recording for an intermission between two musical compositions, thereby reliably detecting... ...or the reproduction of audio data, when this signal level of inputted analog signal or the audio data is retained at level 0 for a **specified** period, T1.

Thus, the system controller 18 sets the end address of data recorded on the magneto-optical disc 1 to another point of time t2, after a lapse of a **specified** period T2, from t1 and updates the management data of the TOC memory 21. In addition, after the recording operation to the magneto-optical disc 1 starts, the signal level of audio information of audio data or the signal level of inputted analog signal is detected after a lapse of **specified** time from the starting of the recording operation to the magneto-optical disc 1. As shown in Fig. 15, this is because if the signal...

Dialog eLink: Order File History

DIALOG(R)File 348: EUROPEAN PATENTS
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17/3K/2 (Item 2 from file: 348)
01132191

Secure distribution system for digital contents
Sicheres Verteilsystem fur digitale Inhalte
Systeme sur de distribution de contenues numeriques

Patent Assignee:

- **SAMSUNG ELECTRONICS CO., LTD.** (1093728)
  416, Maetan-dong, Paldal-gu; Suwon-City, Kyungki-do (KR)
  (Proprietor designated states: all)

Inventor:

- **Kang, Eun-Seong**
  1-103 Samho Apt.,Bangbaebondong; Seocho-gu,Seoul; (KR)
- **Byun, Jin Young**
  Software Center,Abgujung Bld.,599-4 Sinsadong; Kangnam-gu,Seoul; (KR)

Legal Representative:

- **Robinson, Ian Michael et al (79162)**
  Appleyard Lees 15 Clare Road; Halifax HX1 2HY; (GB)

	Country	Number	Kind	Date	
Patent	EP	989710	A2	20000329	(Basic)
Patent	EP	989710	A3	20000719	
Patent	EP	989710	B1	20081203	
Application	EP	99304161		19990528	
Priorities	KR	9839808		19980924	
	KR	9839809		19980924	

Designated States:
DE; FR; GB; IT

Extended Designated States:
AL; LT; LV; MK; RO; SI

Related Divisions: Patent (Application):EP 1691527 (EP 2006076081)

International Patent Class (V7): H04L-029/06; H04L-012/22; H04L-009/08

International Classification (Version 8) IPC	Level	Value	Position	Status	Version	Action	Source	Office
H04L-0029/06	A	I	F	B	20060101	19991214	H	EP
H04L-0012/22	A	I	L	B	20060101	20000530	H	EP
H04L-0009/08	A	I	L	B	20060101	20000530	H	EP

Abstract ...A2

Abstract Word Count: 156
NOTE: Figure number on first page: 3

Legal Status Type	Pub. Date	Kind	Text
...International Patent **Classification** changed...	19		

Language Publication: English
Procedural: English
Application: English

Fulltext Availability Available Text	Language	Update	Word Count
CLAIMS A	(English)	200013	3026
SPEC A	(English)	200013	12170
CLAIMS B	(English)	200849	973
CLAIMS B	(German)	200849	910
CLAIMS B	(French)	200849	1160
SPEC B	(English)	200849	10161
Total Word Count (Document A) 15199			
Total Word Count (Document B) 13204			
Total Word Count (All Documents) 28403			

Specification: ...created by the information providers who are interested in providing integrated information that covers all of the media. Other users want to selectively receive a **specific** item of digital infornnation from the entire **spectrum** of information available from a particular information provider (IP). Accordingly, a digital content transmission system has been formed by the information providers who convert various **types** of information into digital form and store this digital information and store information about the users who subscribe to this digital information system from an... ...user. The MPEG software protocol, for example, compresses audio files to a fraction of their original size, but it has little perceptible affect upon the **quality** of the audio sound. The MPEG software protocol is now used widely by Internet sites to offer digitalized music, and is reported to be used...is a schematic block diagram illustrating another embodiment of the terminal unit shown in Figure 1;

Figure 5 is a schematic block diagram illustrating greater **detail** of the embodiment of a digital cryptograph shown in Figure 1;

Figure 6 is a schematic block diagram illustrating greater **detail** of the embodiment of a digital cryptograph shown in Figure 3;

Figure 7 is a flow chart illustrating the operation of a service server as... ...illustrates a format of user authorization information suitable for application to the unencrypted header field shown in Figures 14 and 15;

Figure 17 illustrates the **details** of a header field as may be used in the header fields shown in Figures 12 and 13;

Figure 18 illustrates a flow chart for... ...may be unique to the user. Once generated, the user key information is stored in a database of the host server with the user's **characteristic** information. The size of the user key information is preferably one hundred and twenty-eight bytes.

A user's key is used for encrypting and... ...the header and to decrypt the encrypted incoming content encryption key, to decrypt and play the encrypted digital information. The hash value has the advantageous **feature** of always providing the same output from the same input without ever permitting the input to be inferred from the output.

The content encryption key... ...numbers and its size a multiple of eight bytes. In the practice of the present invention, the content encryption key is preferably eight bytes. One **feature** of the present invention is that two content encryption keys with the same content will not be generated. For example, the content encryption key may... ...user has requested from the information provider via the system.

The digital information that is requested by the user is sometimes referred to in this **specification** as digital content. Briefly, the digital information is data, such as music or a literary composition, that has been convened into digital signals that are... ...11a and decrypts the encrypted digital content by using the stored decryption algorithm. Replay device 11b may be either portable or stationary, depending upon its **type** of storage media.

Service server 12 generates key information that is based upon the identity characters of the user transmitted from terminal unit 10, stores... ...list may, for example, be the titles of songs or the names of the singers or composers.

Figure 5 is a block diagram showing the **detailed** functional structure of the digital cryptograph of Figure 1, with the functional structure of and the interrelation between the service server and the terminal unit... ...to the header and then transmits the copyright protection protocol to the user's terminal unit 200.

Figure 6 is a block diagram showing the **detailed** functional structure of the digital cryptograph of Figure 3, with the functional structure of and the interrelation between service server 110, host server 120 and... ...to the user's identity characters and then transmits the key information that is generated to terminal unit 20 of the user; steps are not **specifically** described since the processes can be easily inferred from Figures 7 and 8.

When provided with the key information together with the digital information requested... ...information received in the copyright protection protocol format from protocol format encoder 31, in accordance with the header information from the protection protocol format.

More **specifically**, protocol format encoder 30 generates the user's key by using the key information generated in correspondence with the user's identity characters and the... ...determine whether the user is authorized to receive, decode and use the digital information.

Operation of the protocol format processing system will be described in **detail** by now turning to Figures 10 through 16. When the user selects the digital information that he, or she, wants to obtain, the digital cryptograph of the present invention arranges the digital information into the protocol format described in greater **detail** in the following paragraphs, and then transmits the protocol format to the terminal unit of the user.

Figure 10 is an illustration of one protocol...of additional items of digital information included within the copyright protection protocol.

Figure 12 illustrates the header field suitable for Figures 10 and 11 more **specifically**, with a copyright support information field, an unencrypted header field and an encrypted header field. The copyright support information field includes a copyright support code... ...Figures 12 and 13. The unencrypted header field may be arranged with a copyright library version field, a digital conversion format field for indicating the **type** of the digital conversion format a key generation algorithm field for indicating the information on the key generation algorithm, a digital content encryption algorithm field... ...the conversion method are MP3 and AAC. The encryption algorithm field may include a hash algorithm code, key encryption algorithm code, the size of initial **vector** (IV), and information on initial **vector** used for encrypting the digital content. The field for indicating the user authorization information at the computer of the user's terminal unit and the... ...of users sharing the computer at the terminal unit, and a field indicating the number of users sharing the replay device.

Figure 16 illustrates the **detailed** structure of the user authorization information fields suitable for the unencrypted header fields shown in Figures 14 and 15. The user authorization information fields at... ...created by the key encryption algorithm, and a fourth field that indicates the resultant value of the encrypted content encryption key.

Figure 17 illustrates the **details** of an arrangement of an encrypted header that is suitable for use in the header field shown by Figures 12 and 13. The encrypted header... ...added to the header (S210). The unencrypted header field is also generated and added to the header (s220), which field includes the version information, a **type** of music, the code of service provider supporting the copyright, hash algorithm, key generation algorithm, and digital content encryption algorithm.

If the additional information field... ...encryption key.

Figure 20 is a flow chart illustrating the method of generating the user authorization information applied to Figure 19, which describe in more **detail** the method of generating the encryption key information at the step of s230 of Figure 19.

It is determined whether the key information or the... ...the digital content (S490).

Figure 22 illustrates schematically the structure of the replaying device applied to Figure 1 and Figure 3.

Memory 300 includes a **driving** algorithm for the entire system and a plurality of algorithms for decrypting the encrypted digital content. Memory 300 stores in itself the received key information... ...scope of the appended claims.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this **specification** in connection with this application and which are open to public inspection with this **specification**, and the contents of all such papers and documents are incorporated herein by reference.

All of the **features** disclosed in this **specification** (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such **features** and/or steps are mutually exclusive.

Each **feature** disclosed in this **specification** (including any accompanying claims, abstract and drawings), may be replaced by alternative **features** serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each **feature** disclosed is one example only of a generic series of equivalent or similar **features**.

The invention is not restricted to the **details** of the foregoing embodiment(s). The invention extend to any novel one, or any novel combination, of the **features** disclosed in this **specification** (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so...

Specification: ...created by the information providers who are interested in providing integrated information that covers all of the media. Other users want to selectively receive a **specific** item of digital infornnation from the entire **spectrum** of information available from a particular information provider (IP). Accordingly, a digital content transmission system has been formed by the information providers who convert various **types** of information into digital form and store this digital information and store information about the users who subscribe to this digital information system from an... ...user. The MPEG software protocol, for example, compresses audio files to a fraction of their original size, but it has little perceptible affect upon the **quality** of the audio sound. The MPEG software protocol is now used widely by Internet sites to offer digitalized music, and is reported to be used... ...transmission system, as was recently noted by Interdeposit and the French Agency for the Protection of Programs, a member of the **TYPE**=S> European Association of Authors and Information Technology Professional, in the Patent, Trademark & Copyright Journal, volume 57, No.1416, page 385 (11 March 1999 **sample** a partially encrypted score prior to consummating a transaction. When a score is selected, the client enters payment information and is assigned a password that is **specific** to the client and transaction. The password functions as a decryption key to enable use of the musical score by the client employing the access... ...client of the accessing user. The key client of the accessing user uses the key to decrypt the encrypted data file.

TYPE=S> Matyas S M: "Key Handling with Control **Vectors**" IBM Systems Journal, US, IMB Corp. Vol.30, No.2, 1 January 1991 , discloses a method for controlling cryptographic keys usage based on control **vectors**. Each cryptographic key has an associated control **vector** that defines the permitted uses of the key within a cryptographic system. At key generation, the control **vector** is cryptographically coupled to the key via a **special** encryption process.

EP-A-0,739,106 discloses a method for secure session key generation and authentication. A key... ...using the content encryption key.

According to the present invention there is provided an apparatus and method as set forth in the appended claims. Preferred **features** of the invention will be apparent from the dependent claims, and the description which follows.

According to a first aspect of the invention there is... ...of the terminal unit shown in Figure 1;

Figure 5 is a schematic block diagram illustrating greater **detail** of the embodiment of a digital cryptograph shown in Figure 1;

Figure 6 is a schematic block diagram illustrating greater **detail** of the embodiment of a digital cryptograph shown in Figure 3;

Figure 7 is a flow chart... ...for application to the unencrypted header field shown in Figures 14 and 15;

Figure 17 illustrates the **details** of a header field as may be used in the header fields shown in Figures 12 and 13... ...may be unique to the user. Once generated, the user key information is stored in a database of the host server with the user's **characteristic** information. The size of the user key information is preferably one hundred and twenty-eight bytes.

A user's key is used for encrypting and... ...the header and to decrypt the encrypted incoming content encryption key, to decrypt and play the encrypted digital information. The hash value has the advantageous **feature** of always providing the same output from the same input without ever permitting the input to be inferred from the output.

The content encryption key... ...numbers and its size a multiple of eight bytes. In the practice of the present invention, the content encryption key is preferably eight bytes. One **feature** of the present invention is that two content encryption keys with the same content will not be generated. For example, the content encryption key may... ...user has requested from the information provider via the system.

The digital information that is requested by the user is sometimes referred to in this **specification** as digital content. Briefly, the digital information is data, such as music or a literary composition, that has been convened into digital signals that are decrypts the encrypted digital content by using the stored decryption algorithm. Replay device 11b may be either portable or stationary, depending upon its **type** of storage media.

Service server 12 generates key information that is based upon the identity characters of the user transmitted from terminal unit 10, stores... ...be the titles of songs or the names of the singers or composers.

Figure 5 is a block diagram showing the **detailed** functional structure of the digital cryptograph of Figure 1, with the functional structure of and the interrelation between the service server... ...then transmits the copyright protection protocol to the user's terminal unit 200.

Figure 6 is a block diagram showing the **detailed** functional structure of the digital cryptograph of Figure 3, with the functional structure of and the interrelation between service server 110... ...to the user's identity characters and then transmits the key information that is generated to terminal unit 20 of the user; steps are not **specifically** described since the processes can be easily inferred from Figures 7 and 8.

When provided with the... ...information received in the copyright protection protocol format from protocol format encoder 31, in accordance with the header information from the protection protocol format.

More **specifically**, protocol format encoder 30 generates the user's key by using the key information generated in correspondence with the user's identity characters and the... ...determine whether the user is authorized to receive, decode and use the digital information.

Operation of the protocol format processing system will be described in **detail** by now turning to Figures 10 through 16. When the user selects the digital information that he, or she, wants to obtain, the digital cryptograph of the present invention arranges the digital information into the protocol format described in greater **detail** in the following paragraphs, and then transmits the protocol format to the terminal unit of the user.

Figure 10 is an... ...the copyright protection protocol.

Figure 12 illustrates the header field suitable for Figures 10 and 11 more **specifically**, with a copyright support information field, an unencrypted header field and an encrypted header field. The copyright support information field includes a copyright support code... ...IDREF=F0008>13. The unencrypted header field may be arranged with a copyright library version field, a digital conversion format field for indicating the **type** of the digital conversion format a key generation algorithm field for indicating the information on the key generation algorithm, a digital content encryption algorithm field... ...the conversion method are MP3 and AAC. The encryption algorithm field may include a hash algorithm code, key encryption algorithm code, the size of initial **vector** (IV), and information on initial **vector** used for encrypting the digital content. The field for indicating the user authorization information at the computer of the user's terminal unit and the... ...computer at the terminal unit, and a field indicating the number of users sharing the replay device.

Figure 16 illustrates the **detailed** structure of the user authorization information fields suitable for the unencrypted header fields shown in Figures 14 and 15. The user... ...encryption algorithm, and a fourth field that indicates the resultant value of the encrypted content encryption key.

Figure 17 illustrates the **details** of an arrangement of an encrypted header that is suitable for use in the header field shown by Figures 12 and... ...added to the header (S210). The unencrypted header field is also generated and added to the header (s220), which field includes the version information, a **type** of music, the code of service provider supporting the copyright, hash algorithm, key generation algorithm, and digital content encryption algorithm.

If the additional information field... ...is a flow chart illustrating the method of generating the user authorization information applied to Figure 19, which describe in more **detail** the method of generating the encryption key information at the step of s230 of Figure 19.

It is determined whether the...the structure of the replaying device applied to Figure 1 and Figure 3.

Memory 300 includes a **driving** algorithm for the entire system and a plurality of algorithms for decrypting the encrypted digital content. Memory 300 stores in itself the received key information... ...scope of the appended claims.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this **specification** in connection with this application and which are open to public inspection with this **specification**, and the contents of all such papers and documents are incorporated herein by reference.

All of the **features** disclosed in this **specification** (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such **features** and/or steps are mutually exclusive.

Each **feature** disclosed in this **specification** (including any accompanying claims, abstract and drawings), may be replaced by alternative **features** serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each **feature** disclosed is one example only of a generic series of equivalent or similar **features**.

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A system and method for querying a music database
System und Verfahren zum Abfragen einer Musikdatenbank
Systeme et methode d'interrogation d'une base de donnees musicale

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G10H-0001/00	A	I	L	B	20060101	20001207	H	EP

Abstract ...pieces of music, where the query (104) is performed by forming a database request consisting of a conditional expression relating to the name and/or **attributes** of the desired piece of music. Associated **parameters** are derived from the database query, and compared with corresponding **parameters** for the other pieces of music in the database (302). A desired piece of music is determined

by searching for a minimum distance between the database query **parameters** and those associated with the pieces of music in the database (302).

Abstract Word Count: 102
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CLAIMS A	(English)	199945	3084
SPEC A	(English)	199945	7633
CLAIMS B	(English)	200940	1954
CLAIMS B	(German)	200940	1805
CLAIMS B	(French)	200940	2277
SPEC B	(English)	200940	7786
Total Word Count (Document A) 10719			
Total Word Count (Document B) 13822			
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Specification: ...The present invention relates to the field of music systems and, in particular, to the identification and retrieval of particular pieces of music or alternately, **attributes** of a desired piece of music, from a music database on the basis of a query composed of desired **features** and conditional statements. BACKGROUND OF THE INVENTION

Retrieval of music or music **attributes** from a database requires, in common with generic database functionality, a query method which is powerful and flexible, and preferably intuitively meaningful to the user... ...to systematic search and sort procedures. This latter aspect in turn requires that pieces of music be characterised in a manner which permits of such **classification**.

Thus a hierarchy of requirements or elements which make up a music database system are as follows:

* characterising music using **attributes** useful in a **classification** scheme

* classifying music in a meaningful searchable structure, and

* querying the database so formed, to yield meaningful results.

The hierarchy, has been defined "bottom up... ...a more meaningful progression by which the invention can be described.

When considering audio signals in general, and in particular those relating to music, the **nature** of the signals may be considered in **terms** of various **attributes** which are intuitively meaningful. These **attributes** include, among others, tempo, loudness, pitch and timbre. Timbre can be considered to be made up of a number of constituent sub-**features** including "sharpness" and "percussivity". These **features** can be extracted from music and are useful in characterising the music for a **classification** scheme.

The publication entitled "Using Bandpass and Comb Filters to Beat-track Digital Audio" by Eric D. Scheirer (MIT Media Laboratory, December 20, 1996) discloses... ...desktop workstation or alternately, a multi-processor architecture may be utilised. This method suffers from the disadvantage of being highly computationally intensive.

Percussivity is that **attribute** which relates to a family of musical instruments known as "percussion" when considering an orchestra or a band. This family includes such musical instruments as drums, cymbals, castanets and others. Processing of audio signals in general and musical signals in particular, benefits from the ability to estimate various **attributes** of the signals, and the present invention is concerned with estimating the **attribute** of percussivity.

A number of different methods have been used to estimate percussivity of a given signal, such methods including those broadly based upon:

* Short-time power analysis

* statistical analysis of signal amplitude

* comparison of harmonic **spectral** component power with total **spectral** power

Short-time signal power estimation involves calculation of an equivalent power (or an approximation thereof) within a short segment or "window" of a signal... ...The power estimate can be compared to a threshold in order to determine whether the portion of the signal within the window is percussive in **nature**. Alternatively, the power estimate can be compared to a sliding scale of thresholds, and the percussive content of the signal classified with reference to the... ...in a neighborhood in order to determine whether signal variations in the running mean are sufficiently large to signify that the signal is percussive.

Harmonic **spectral** component power analysis involves taking a windowed Fourier transform of the signal in question over the time period of interest, and then examining the resulting set of **spectral** components. The **spectral** components which are indicative of harmonic series are removed. It is noted that such harmonic series components typically represent local maxima in the overall **spectral** envelope of the signal. After removing the harmonic series **spectral** components, remaining **spectral** components substantially consist only of the inharmonic components of the signal, these being considered to represent percussive components of the signal. The total power in... ...all components, harmonic and non-harmonic, to yield an indication of percussivity.

The aforementioned analysis methods are typically intended to identify a range of signal **attributes**, and thus suffer from relatively limited accuracy, and a tendency to produce false or unreliable percussivity

estimates. The methods are also relatively complex and thus expensive to implement, particularly the harmonic **spectral** component estimation method.

U.S. Patent No. 5,616,876 (Cluts et al) entitled "System and Methods for Selecting Music on the Basis of Subjective... ...to identify other songs similar to the seed song, the similarity between songs being based on the subjective content of the songs, as reflected in **style** tables prepared by editors. The system and methods described in this publication are based on the manual categorisation of music, with the attendant requirement for human participation in the process, with the resultant speed, accuracy and repeatability of the process limited by human **attributes**.

The publication entitled "Content - Based **Classification**, Search, and Retrieval of Audio" by Erling et al (IEEE Multimedia Vol. 3, No. 3, 1996, pp.27-36) discloses indexing and retrieving short audio files (i.e. "sounds") from a database. **Features** from the sound in question are extracted, and **feature vectors** based on statistical measures relating to the **features** are generated. Both the sound and the set of **feature vectors** are stored in a database for later search and retrieval. A method of **feature** comparison is used to determine whether or not a selected sound is similar to another sound stored in the database. The **feature** set selected does not include tempo and thus the system will not perform well in differentiating between pieces of music. Furthermore, the method determines **features** which provide scalar statistical measures over short time windows. Furthermore, the method uses **features** such as bandwidth which are not readily conceptualized in **terms** of impact of music selection.

It is seen from the above that existing arrangements have shortcomings in all elements in the hierarchy of requirements described... ...a method for querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of **parameters**, the method comprising the steps of:

forming a request which **specifies** one or more pieces of music and/or associated **parameters** and one or more conditional expressions;

determining associated **parameters** for the **specified** pieces of music if the **parameters** have not been **specified** ;

comparing the **specified parameters** and corresponding **parameters** associated with other pieces of music in the database;

calculating a distance based on the comparisons;

identifying pieces of music which are at distances from the **specified** pieces of music as to satisfy the conditional expressions.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention will be described in **detail** with reference to the accompanying drawings in which:

Fig. 1 depicts a music database system in a kiosk embodiment;

Fig. 2 illustrates a music database system in a network embodiment;

Fig. 3 provides a functional description of a music database system;

Fig. 4 illustrates a generic **feature** extraction process;

Fig. 5 depicts the tempo **feature** extraction process;

Fig. 6 presents a further illustration of the tempo **feature** extraction process;

Fig. 7 depicts a process flow diagram for a preferred embodiment of the percussivity estimator;

Fig. 8 presents more **detail** of the preferred embodiment;

Fig. 9 illustrates a preferred embodiment of a comb filter;

Fig. 10 depicts a linear function obtained from the comb filter... ...12 presents an accumulated histogram of a signal having an overall low percussivity;

Fig. 13 illustrates a typical percussive signal;

Fig. 14 depicts a generic **feature classification** process;

Fig. 15 shows a database query process - music identifiers supplied in query;

Fig. 16 illustrates a database query process - music **features** supplied in query;

Fig. 17 illustrates a distance metric used to assess similarity between two pieces of music; and

Fig. 18 - 21 depict **feature** representations for four pieces of music; and

Fig. 22 depicts a general purpose computer upon which the preferred embodiment of the invention can be practiced.

DETAILED DESCRIPTION

Fig. 1 depicts a music database system in a kiosk 102 embodiment. For the purpose of the description it is noted that "kiosk" is... ...to the kiosk and inputs a music query 104 to the kiosk 102, which after performing a search of the kiosk music database based on **parameters** in the music query 104, outputs a desired piece of music 106 which is based on the music query 104. The kiosk 102 also outputs... ...the desired piece of music 106. Such identifiers could include, for example, the name of the piece of music. Considering first the music input and **classification** process, a piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. In parallel with this process, the actual music piece itself 100 is stored in music database 302. Thus the piece of music 100 and its associated representative **features** are stored in two databases 302 and 308. Next considering the database query process, the user query 104 is input whereupon

feature comparison 312 is performed between the **features** associated with the user query 104 and the **features** of the pieces of music stored in the **feature** database 308. After a successful search, a music selection process 314 extracts the desired piece of music 106 from music database 302 on the basis of the **feature** comparison 312, and outputs the desired piece of music 106 and/or music identifiers 108 associated with the desired piece of music 106.

Fig. 4 depicts a generic **feature** extraction process. Recalling from the functional description of the database system in Fig. 3, the piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. In Fig. 5, the piece of music 100 is input, and **feature** extraction process 304 is seen to include, in this illustration, four parallel processes, one for each **feature** . The tempo extraction process 402 operates upon the input piece of music 100 to produce tempo data output 404. The loudness extraction process 406 operates... ...416 and percussivity data output 418. Thus, referring again to Fig. 3 it is seen that for this example, the output line 332 between the **feature** comparison process 312 and the **feature** database 308 is handling four different data sets 504, 508, 512, 516.

Fig. 5 shows the tempo **feature** extraction process 402 (described in Fig. 4) and will be described in some **detail**. Tempo extraction firstly involves determination of the onset signal 620 from the piece of music 100, and then filtering this onset signal through a bank... ...card 216, where say a Fast Fourier Transform (FFT) can be performed using a Digital Signal Processor (DSP). Furthermore, comb filters, described in relation to **feature** extraction, can also be implemented using a DSP on the audio card 216. Alternatively, these processes can be performed by the general purpose processor 102... ...full duration of the piece of music 100. In an alternate embodiment, the onset signal 618 could be derived by sampling signal 628, comparing consecutive **samples** to detect positive peaks of the signal 614, and generating pulses 628 each time such a peak is detected. A brief explanation about the effect... ...Summing frequency component amplitudes in each window is a form of decimation (i.e. reduction of the sampling frequency), since the number of digitised music **samples** in a window are summed to form one resultant point. Thus selection of the window size has the effect of reducing the number of **sample** points. The optimum selection of window size requires a balance between the accuracy of the resultant representation of the **feature**, and compression of the data in order to reduce computational burden. The inventor has found that a 256 point FFT (equivalent to an 11.6 msec music window size) yields good performance when using the resultant **feature** for comparing and selecting music pieces in regard to tempo. Once significant changes in the **spectrum** (i.e. the starting points of notes 616) are located, the onset signal 618 is passed through a bank of comb filters in order to... ...output

xt)) represents the onset signal (618).

Each of these comb filters has a resonant frequency (at which the output is reinforced) determined by the **parameter** 1/(tau). The **parameter** (alpha) (alpha) corresponds to the amount of weighting placed on previous inputs relative to the amount of weighting placed on current and future inputs. The onset signal 618 is filtered through the bank of comb filters, whose resonant frequencies are placed at frequencies which are at multiple **sample** spacings resulting from windowing. The filters should typically cover the range from about 0.1Hz through to about 8Hz. The filter with the highest energy output at each **sample** point is considered to have "won", and a tally of wins is maintained for each filter in the filterbank, for example by using a power... ...present in the original music signal 100. Secondary tempo's may also be identified using the method.

The timbre of a sequence of sound, which **feature** is **characteristic** of the difference in sounds say between two musical instruments, is largely dependent upon the frequencies present, and their respective magnitudes.

The **spectral** centroid provides an estimate of "brightness" or "sharpness" of the sound, and is one of the metrics used in the present embodiment in relation to extraction of timbre. This brightness **characteristic** is given by: where:

S = **spectral** centroid

f = frequency

A = Amplitude

W = Window selected

In order to differentiate between the timbral **characteristics** of different audio signals, the present embodiment makes use of the Fourier transform of successive 0.5 second windows of the audio signal 100 in question. There is no necessary relationship between the window size used for loudness **feature** extraction and that used for tempo or other **feature** extraction. Other techniques for extracting timbre may be used.

Percussivity is that **attribute** which relates to a family of musical instruments known as "percussion" when considering an orchestra or a band. This family includes such musical instruments as... ...signal 736 is operated upon by a windowing process 710 which outputs a windowed signal on line 734, the windowed signal being shown in more **detail** in an inset 712. In the inset 712 windows, exemplified by a window 738, each having a predetermined width 708, are overlapped with each other... ...of individual comb filters exemplified by comb filter 718. The structure and operation of an embodiment of the comb filter 718 is presented in more **detail** in relation to Fig. 3. The comb filter 718 integrates the energy of the signal 736 across the particular window 738 being considered. The bank... ...process 722 which determines a straight line of best fit 732 which approximates the output signal exemplified by signal 726.

Fig. 8 presents a more **detailed** description of the preferred embodiment of the percussivity estimator as it relates to a digitised input signal. Given an input signal on line 800 to... ...between 200 Hz and 3000 Hz. The number and spacing of the individual comb filters 718 in the comb filter bank are discussed in more **detail** in relation to Fig. 9. The linear function on line 812 which is formed from the peak energy output of each comb filter comprising the... ...t) is an input signal 900 to the comb filter;

y(t) is an output signal 906 from the comb filter;

T is a delay **parameter** determining the period of the comb filter; and

a is a gain factor determining the frequency selectivity of the comb filter.

For each comb filter 718 in the bank of comb filters 740 (see Fig. 7), the delay factor T is selected to be an integral number of **samples** long, the **sample attributes** being determined by process 802 (see Fig. 8). In the preferred embodiment of the comb filter bank 740, the number of filters 718 in the bank 740 is determined by the number of integral **sample** lengths between the resonant frequency edges, these edges being defined in the embodiment described in relation to Fig. 8 to be 200 Hz and 3000... ...in the time domain, where the signal 1304 is plotted as a function of an amplitude axis 1300 and a time axis 1302.

The loudness **feature** is representative of the loudness over substantially the full duration of the piece of music 100 (see Fig. 1). The piece of music 100 is first partitioned into a sequence of time windows, which for the purpose of **classification** and comparison on the basis of loudness, should be preferably about one half a second wide. There is no necessary relationship between the window size used for loudness **feature** extraction and that used for tempo or other **feature** extraction. The Fourier transform of the signal in each window is taken, and then the power in each window is calculated. The magnitude of this... ...is an estimate of the loudness of the music within the corresponding half-second interval. Other methods of extracting loudness are known.

Pitch is another **feature** in the present embodiment determined by the **feature** extraction means in order to represent music while storing a new piece of music into the music database. The localised pitch is determined over a... ...0.1 seconds in this instance) by using a bank of comb filters. There is no necessary relationship between the window size used for pitch **feature** extraction and that used for tempo or other **feature** extraction. These comb filters have resonant frequencies covering a range of valid pitches. Advantageously this includes frequencies from around 200Hz up to around 3500Hz, and the filters are spaced at intervals determined by the rate at which the original musical signal was **sampled**. The **sampled** signal is filtered through the filter bank, and the comb filter that has the greatest output power will have a resonant frequency corresponding to the... ...a number of methods for pitch extraction which exists and other methods may be used.

Returning to Fig. 3, and considering the music input and **classification** process, when the piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. Substantially in parallel with this process, the actual music piece itself 100 is stored in music database 302. Thus the piece of music 100 and the associated representative **features** are stored in two distinct but related databases 302 and 308 respectively. If the music is initially derived from an analogue source, it is first digitised before being input into the **feature** extraction process 304. The digitisation step may be implemented by way of a standard soundcard or, if the music is already in digital form, this Musical Instrument Digital Interface (MIDI) format and others may be supported in the system. There are no **specific** requirements in **terms** of sampling rate, bits per **sample**, or channels, but it should be noted that if higher reproduction **quality** is desirable it is preferable to select an audio resolution close to that of a CD.

Fig. 14 depicts a generic **feature classification** process. Extracted **feature** signals 404, 408, 412, 416 and 418 (refer Fig. 4) are accumulated in process step 1404 as histograms over substantially the whole duration of the piece of music 100 resulting in an indicative **feature** output 1406 for each extracted **feature** signal. This output 1406 is stored in the **feature** database 308. By identifying the N highest tempo's in the manner described in Figs. 5 and 6, a histogram describing the relative occurrence of... ...pitches, a histogram describing the relative occurrence of each pitch across substantially the whole duration of the piece of music 100 can be formed. The **spectral** centroid is advantageously used to

describe the sharpness in a window. This can be accumulated as a histogram over substantially the full duration of the... ...a histogram describing the relative occurrence of each sharpness across substantially the whole duration of the piece of music 100 can be formed. Accumulation of **features** as histograms across substantially the entire duration of pieces of music yields a duration independent mechanism for **feature classification** suitable for search and comparison between pieces of music. This forms the foundation for **classification** in the music database system. The **spectral** centroid is advantageously used to describe the percussivity in a window. This can be accumulated as a histogram over substantially the full duration of the... ...of forms which include, but are not limited to:

(1) a set of names of known pieces of music and a degree of similarity/dissimilarity **specified** by a conditional expression (shown underlined) for each piece (e.g. very much like "You can hear me in the harmony" by Harry Conick Jr., a little like "1812 Overture" by Tchaikovsky, and not at all like "Breathless" by Kenny G);

(2) a set of user **specified features** and a similarity/dissimilarity **specification** in the form of a conditional expression (e.g. something that has a tempo of around 120 beats per minute, and is mostly **loud**).

In Fig. 15, the music query 104, containing music identifiers and conditional expressions is input into the **feature** comparison process 312 (see Fig. 3). This process 312 includes the **feature** retrieval process 1502 which retrieves the **features** associated with the pieces of music named in the music query 104 from **feature** database 308. Next these retrieved **features** are passed to similarity comparison process 1504 which searches the **feature** database 308 for **features** satisfying the conditional expression contained in music query 104 as applied to the **features** associated with pieces of music named in music query 104. The results of this comparison are passed to the identifier retrieval process 1506 which retrieves the music identifiers of the pieces of music whose **features** satisfy the conditional expressions as applied to the identifiers **specified** in music query 104. These identifiers are passed to the music selection process 314 which enables the output of the desired music 106 and/or music identifiers 108 from music database 302 and **feature** database 308 respectively.

Fig. 16 describes a database query process where music **features** are supplied in the music query 104. The music query 104, containing music **features** and conditional expressions, is available at the query stage 104 and thus in this case the **feature** retrieval process 1502 is bypassed (see Fig. 15). Next these provided **features** are passed to the similarity comparison process 1604 which searches the **feature** database 308 for **features** satisfying the conditional expression contained in music query 104 as applied to the **features** provided in the music query 104. The results of this comparison are passed to the identifier retrieval process 1606 which retrieves the music identifiers of the pieces of music whose **features** satisfy the conditional expressions in relation to the identifiers **specified** in music query 104. These identifiers are passed to the music selection process 314 which ensures the output of the desired music 106 and/or music identifiers 108 from music database 302 and **feature** database 308 respectively.

Considering the process of **feature** comparison 312, a similarity comparison is performed between the **features** of music stored by the system in the **feature** database 308 which correspond to pieces of music 100 stored in music database 302, and **features** corresponding to the music query 104. Since a number of different **features** (and **feature** representations) exist in the **feature** database 308, the comparisons

between corresponding **features** are advantageously performed differently for each **feature**, for example:

* comparison between loudness **features** stored as histograms are made through the use of a histogram difference. or comparison of a number of moments about the mean of each histogram. or other methods that achieve the same goal;

* comparison between tempo **features** stored as histograms are accomplished by methods such as histogram difference, or comparison of a number of moments about the mean of each histogram or other methods that achieve the same goal,

* comparison between pitch **features** stored as histograms are performed using a histogram difference, or a comparison of a number of moments about the mean of each histogram. Other methods for comparison of pitch **features** may also be used,

* comparison between sharpness **features** stored as histograms are achieved through the use of methods such as histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal, and

* comparison between percussivity **features** stored as histograms are achieved through the use of methods such as histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal.

Once the comparison of each of the relevant **features** has been made, the overall degree of similarity is ascertained. A simple, yet effective way of determining this is through the use of a distance metric (also known as the Minkowski metric with r = 1), with each of the **feature** comparison results representing an individual difference along an orthogonal axis.

Fig. 17 illustrates a distance metric used to assess the similarity between two pieces of music where D is the distance between the two pieces of music 1708 and 1710 (only 3 **features** are shown for ease of representation). In this case, a smaller value of D represents a greater similarity. D is advantageously represented by:

Fig. 17 illustrates the distance between two pieces of music 1708, 1710, these pieces of music being defined in **terms** of three exemplary **features** namely pitch 1702, tempo 1704, and sharpness 1706. Distance D 1712 represents the distance between the pieces of music 1710 and 1708 when measured in this context.

The above method will be partially described for a **specific** query 104 namely "Find a piece of music similar to piece A", where the database contains pieces of music A, B, C, and D. This query 104 is of a **type** described in Fig. 15 where music identifiers (ie the name of the piece of music "A") and a conditional expression ("similar to") is provided in the **query** 104.

Each piece of **music** stored in the database is represented by a number of **features** that have been extracted when the pieces were classified and stored in the database. For the sake of simplicity the

example presented is restricted to two **features**, namely tempo and sharpness, where both **features** are represented by simplified histograms.

The four music pieces to be considered are named A, B, C and D. Their corresponding **feature** histograms are illustrated in Figs. 18-21.

Fig. 18 illustrates a tempo histogram and a timbre (alternatively called sharpness) histogram for piece of music A... ...22050 Hz (1804) for 20% of the time (1810) and a brightness of 44100 Hz (1806) for 80% of the time (1812). Figs. 19 - 21 **display similar features** for pieces of **music** B - D.

When the **query** is presented, the following sequence of operations is performed:

* Comparison of the **features** of A and B

* Comparison of the **features** of A and C

* Comparison of the **features** of A and D

* Selection of the music that is least distant from A

Since all **features** of the music in the database are preferably represented as histograms, comparisons between these **features** is based on a comparison between the histograms. Two methods that are useful in forming this comparison are the histogram difference, and the comparison of... ...histogram difference, the calculation of distance is performed as follows:

The difference between A and B in regard to tempo is: where the number of **terms** in the numerator is determined by the number of histogram points being compared, and the denominator is determined by the fact that two histograms are... ...B in regard to timbre:

Thus, distance between A and B is given by:

If we consider the histograms in Figs. 18-21 for the **features** extracted from the piece of music A, B, C and D:

Music A, tempo histogram:

Music A, sharpness histogram:

Music B, tempo histogram:

Music B... ...however, the other pieces of music in the database namely D, E, ..., K, ... would be assessed in order to establish which piece of music had **features** which could simultaneously satisfy the requirements of being at a minimum distance from A, a larger distance from B, and a maximum distance from C.

It is further possible to apply a weighting to each individual **feature** in order to bias the overall distance metric in some fashion (for example biasing in favour of tempo similarity rather than loudness similarity).

In considering similarity assessment on the basis of either the histogram difference, or the comparison of moments, these being applied to the **attributes** of pitch, loudness, tempo, and timbre (i.e. sharpness and percussivity), it is found that two-pass assessment provides better **classification** results in some cases. The two-pass assessment process performs a first assessment on the basis of loudness, percussivity and sharpness. and then a second sorting process based on tempo. In the present embodiments, it is found that the **feature** of pitch may be omitted from the similarity assessment process without significantly degrading the overall similarity assessment results.

In considering similarity assessment using the comparison of moments process, good results are produced by selecting particular moments for each **feature** as shown in the following table: where "mean" and "variance" are determined in accordance with the following general form which expresses moments about the mean... ...the peak, and represents the relative strength of the dominant tempo.

Application of clustering techniques to a complete set of moments corresponding to the extracted **features**, including the mode of each histogram, provides better **classification** results in some cases. Use of Bayesian estimation produces a "best" set of classes by which a given dataset may be classified.

Fig. 22 shows... ...executed by the computer 2200. The use of the computer program product in the computer preferably effects an apparatus for (i) extracting one or more **features** from a music signal, said **features** including, for instance, tempo, loudness, pitch, and timbre, (ii) **classification** of music using extracted **features**, and (iii) method of querying a music database. Corresponding systems upon which the above method steps may be practised may be implemented as described by...

Specification: ...The present invention relates to the field of music systems and, in particular, to the identification and retrieval of particular pieces of music or alternately, **attributes** of a desired piece of music, from a music database on the basis of a query composed of desired **features** and conditional statements. BACKGROUND OF THE INVENTION

Retrieval of music or music **attributes** from a database requires, in common with generic database functionality, a query method which is powerful and flexible, and preferably intuitively meaningful to the user... ...to systematic search and sort procedures. This latter aspect in turn requires that pieces of music be characterised in a manner which permits of such **classification**.

Thus a hierarchy of requirements or elements which make up a music database system are as follows:

characterising music using **attributes** useful in a **classification** scheme

classifying music in a meaningful searchable structure, and

querying the database so formed, to yield meaningful results.

The hierarchy has been defined "bottom up... ...a more meaningful progression by which the invention can be described.

When considering audio signals in general, and in particular those relating to music, the **nature** of the signals may be considered in **terms** of various **attributes** which are intuitively meaningful. These **attributes** include, among others, tempo, loudness, pitch and timbre. Timbre can be considered to be made up of a number of constituent sub-**features** including "sharpness" and "percussivity". These **features** can be extracted from music and are useful in characterising the music for a **classification** scheme.

The publication entitled "**TYPE**=B> Using Bandpass and Comb Filters to Beat-track Digital Audio" by Eric D. Scheirer (MIT Media Laboratory, December 20, 1996) discloses a method... ...desktop workstation or alternately, a multi-processor architecture may be utilised. This method suffers from the disadvantage of being highly computationally intensive.

Percussivity is that **attribute** which relates to a family of musical instruments known as "percussion" when considering an orchestra or a band. This family includes such musical instruments as drums, cymbals, castanets and others. Processing of audio signals in general and musical signals in particular, benefits from the ability to estimate various **attributes** of the signals, and the present invention also addresses estimating the **attribute** of percussivity.

A number of different methods have been used to estimate percussivity of a given signal, such methods including those broadly based upon:

Short-time power analysis

statistical analysis of signal amplitude

comparison of harmonic **spectral** component power with total **spectral** power

Short-time signal power estimation involves calculation of an equivalent power (or an approximation thereof) within a short segment or "window" of a signal... ...The power estimate can be compared to a threshold in order to determine whether the portion of the signal within the window is percussive in **nature**.

Alternatively, the power estimate can be compared to a sliding scale of thresholds, and the percussive content of the signal classified with reference to the... ...in a neighborhood in order to determine whether signal variations in the running mean are sufficiently large to signify that the signal is percussive.

Harmonic **spectral** component power analysis involves taking a windowed Fourier transform of the signal in question over the time period of interest, and then examining the resulting set of **spectral** components. The **spectral** components which are indicative of harmonic series are removed. It is noted that such harmonic series components typically represent local maxima in the overall **spectral** envelope of the signal. After removing the harmonic series **spectral** components, remaining **spectral** components substantially consist only of the inharmonic components of the signal, these being considered to

represent percussive components of the signal. The total power in... ...all components, harmonic and non-harmonic, to yield an indication of percussivity.

The aforementioned analysis methods are typically intended to identify a range of signal **attributes**, and thus suffer from relatively limited accuracy, and a tendency to produce false or unreliable percussivity estimates. The methods are also relatively complex and thus expensive to implement, particularly the harmonic **spectral** component estimation method.

U.S. Patent No. 5,616,876 (Cluts et al) entitled "System and Methods for Selecting... ...to identify other songs similar to the seed song, the similarity between songs being based on the subjective content of the songs, as reflected in **style** tables prepared by editors. The system and methods described in this publication are based on the manual categorisation of music, with the attendant requirement for human participation in the process, with the resultant speed, accuracy and repeatability of the process limited by human **attributes**.

The publication entitled "**TYPE**=S> Content - Based **Classification**, Search, and Retrieval of Audio" by Wold et al (IEEE Multimedia Vol. 3, No. 3, 1996, pp.27-36) discloses indexing and retrieving short audio files (i.e. "sounds") from a database. **Features** from the sound in question are extracted, and **feature vectors** based on statistical measures relating to the **features** are generated. Both the sound and the set of **feature vectors** are stored in a database for later search and retrieval. The **feature** set selected does not include tempo and thus the system will not perform well in differentiating between pieces of music. Furthermore, the method determines **features** which provide scalar statistical measures over short time windows. Furthermore, the method uses **features** such as bandwidth which are not readily conceptualized in **terms** of impact of music selection.

The publication entitled "**TYPE**=S> Music Databases: Indexing Techniques and Implementation" by Chou et al, International Workshop on Multimedia Database Management Systems, Proceedings of International Workshop and Multimedia Database... ...database, a corresponding apparatus and a computer readable medium.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention will be described in **detail** with reference to the accompanying drawings in which:

Fig. 1 depicts a music database system in a kiosk embodiment;

< IDREF...>

Fig. 3 provides a functional description of a music database system;

Fig. 4 illustrates a generic **feature** extraction process;

Fig. 5 depicts the tempo **feature** extraction process;

Fig. 6 presents a further illustration of the tempo **feature** extraction process;

Fig. 7 depicts a process flow diagram for a preferred embodiment of the percussivity estimator;

Fig. 8 presents more **detail** of the preferred embodiment;

Fig. 9 illustrates a preferred embodiment of a comb filter;

Fig. 10 depicts... ...having an overall low percussivity;

Fig. 13 illustrates a typical percussive signal;

Fig. 14 depicts a generic **feature classification** process;

Fig. 15 shows a database query process - music identifiers supplied in query;

Fig. 16 illustrates a database query process - music **features** supplied in query;

Fig. 17 illustrates a distance metric used to assess similarity between two pieces of music; and

Fig. 18 - 21 depict **feature** representations for four pieces of music; and

Fig. 22 depicts a general purpose computer upon which the preferred embodiment of the invention can be practiced.

DETAILED DESCRIPTION

Fig. 1 depicts a music database system in a kiosk 102 embodiment. For the purpose of the description it is... ...to the kiosk and inputs a music query 104 to the kiosk 102, which after performing a search of the kiosk music database based on **parameters** in the music query 104, outputs a desired piece of music 106 which is based on the music query 104. The kiosk 102 also outputs... ...the desired piece of music 106. Such identifiers could include, for example, the name of the piece of music. Considering first the music input and **classification** process, a piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. In parallel with this process, the actual music piece itself 100 is stored in music database 302. Thus the piece of music 100 and its associated representative **features** are stored in two databases 302 and 308. Next considering the database query process, the user query 104 is input whereupon **feature** comparison 312 is performed between the **features** associated with the user query 104 and the **features** of the pieces of music stored in the **feature** database 308. After a successful search, a music selection process 314 extracts the desired piece of music 106 from music database 302 on the basis of the **feature** comparison 312, and outputs the desired piece of music 106 and/or music identifiers 108 associated with the desired piece of music 106.

Fig. 4 depicts a generic **feature** extraction process. Recalling from the functional description of the database system in Fig. 3, the piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. In Fig. 5, the piece of music 100 is input, and **feature** extraction process 304 is seen to include, in this illustration, four parallel processes, one for each **feature**. The tempo extraction process 402 operates upon the input piece of music 100 to produce tempo data output 404. The loudness extraction process 406 operates... ...output

418. Thus, referring again to Fig. 3 it is seen that for this example, the output line 332 between the **feature** comparison process 312 and the **feature** database 308 is handling five different data sets 404, 408, 412, 416 and 418.

Fig. 5 shows the tempo **feature** extraction process 402 (described in Fig. 4) and will be described in some **detail**. Tempo extraction firstly involves determination of an onset signal 618 (shown in Fig. 6) from the piece of music 100, and ... ...22), where say a Fast Fourier Transform (FFT) can be performed using a Digital Signal Processor (DSP). Furthermore, comb filters, described in relation to **feature** extraction, can also be implemented using a DSP on the audio card 2216. Alternatively, these processes can be performed by the general purpose processor 2204... ...full duration of the piece of music 100. In an alternate embodiment, the onset signal 618 could be derived by sampling signal 628, comparing consecutive **samples** to detect positive peaks of the signal 614, and generating pulses 628 each time such a peak is detected. A brief explanation about the effect... ...Summing frequency component amplitudes in each window is a form of decimation (i.e. reduction of the sampling frequency), since the number of digitised music **samples** in a window are summed to form one resultant point. Thus selection of the window size has the effect of reducing the number of **sample** points. The optimum selection of window size requires a balance between the accuracy of the resultant representation of the **feature**, and compression of the data in order to reduce computational burden. The inventor has found that a 256 point FFT (equivalent to an 11.6 msec music window size) yields good performance when using the resultant **feature** for comparing and selecting music pieces in regard to tempo. Once significant changes in the **spectrum** (i.e. the starting points of notes 616) are located, the onset signal 618 is passed through a bank of comb filters in order to... ...x t)) represents the onset signal (618).

Each of these comb filters has a resonant frequency (at which the output is reinforced) determined by the **parameter** / tau 1 . The **parameter** alpha (alpha) corresponds to the amount of weighting placed on previous inputs relative to the amount of weighting placed on current and future inputs. The onset signal 618 is filtered through the bank of comb filters, whose resonant frequencies are placed at frequencies which are at multiple **sample** spacings resulting from windowing. The filters should typically cover the range from about 0.1Hz through to about 8Hz. The filter with the highest energy output at each **sample** point is considered to have "won", and a tally of wins is maintained for each filter in the filterbank, for example by using a power... ...present in the original music signal 100. Secondary tempo's may also be identified using the method.

The timbre of a sequence of sound, which **feature** is **characteristic** of the difference in sounds say between two musical instruments, is largely dependent upon the frequencies present, and their respective magnitudes.

The **spectral** centroid provides an estimate of "brightness" or "sharpness" of the sound, and is one of the metrics used in the present embodiment in relation to extraction of timbre. This brightness **characteristic** is given by: s = (sum) w f A / (sum) * A

where:

S = **spectral** centroid

f = frequency

A = Amplitude

W = Window selected

In order to differentiate between the timbral **characteristics** of different audio signals, the present embodiment makes use of the Fourier transform of successive 0.5 second windows of the audio signal 100 in question. There is no necessary relationship between the window size used for loudness **feature** extraction and that used for tempo or other **feature** extraction. Other techniques for extracting timbre may be used.

Percussivity is that **attribute** which relates to a family of musical instruments known as "percussion" when considering an orchestra or a band. This family includes such musical instruments as... ...signal 736 is operated upon by a windowing process 710 which outputs a windowed signal on line 734, the windowed signal being shown in more **detail** in an inset 712. In the inset 712 windows, exemplified by a window 738, each having a predetermined width 708, are overlapped with each other... ...of individual comb filters exemplified by comb filter 718. The structure and operation of an embodiment of the comb filter 718 is presented in more **detail** in relation to Fig. 9. The comb filter 718 integrates the energy of the signal 736 across the particular window 738... ...best fit 732 (shown in inset 730) which approximates the output signal exemplified by signal 726.

Fig. 8 presents a more **detailed** description of the preferred embodiment of the percussivity estimator as it relates to a digitised input signal. Given an input signal on line 800 to... ...between 200 Hz and 3000 Hz. The number and spacing of the individual comb filters 718 in the comb filter bank are discussed in more **detail** in relation to Fig. 9. The linear function on line 812 which is formed from the peak energy output of each... ...t) is an input signal 900 to the comb filter;

y(t) is an output signal 906 from the comb filter;

T is a delay **parameter** determining the period of the comb filter; and

a is a gain factor determining the frequency selectivity of the comb filter.

For each comb filter... ...the bank of comb filters 740 (see Fig. 7), the delay factor T is selected to be an integral number of **samples** long, the **sample attributes** being determined by process 802 (see Fig. 8). In the preferred embodiment of the comb filter bank 740, the number of filters 718 in the bank 740 is determined by the number of integral **sample** lengths between the resonant frequency edges, these edges being defined in the embodiment described in relation to Fig. 8 to be... ...in the time domain, where the signal 1304 is plotted as a function of an amplitude axis 1300 and a time axis 1302.

The loudness **feature** is representative of the loudness over substantially the full duration of the piece of music 100 (see Fig. 1). The piece of music 100 is first partitioned into a sequence of time windows, which for the purpose of **classification** and comparison on the basis of loudness, should be preferably about one half a second wide. There is no necessary relationship between the window size used for loudness **feature** extraction and that used for tempo or other **feature** extraction. The Fourier transform of the signal in each window is taken, and then the power in each window is calculated. The magnitude

of this... ...is an estimate of the loudness of the music within the corresponding half-second interval. Other methods of extracting loudness are known.

Pitch is another **feature** in the present embodiment determined by the **feature** extraction means in order to represent music while storing a new piece of music into the music database. The localised pitch is determined over a... ...0.1 seconds in this instance) by using a bank of comb filters. There is no necessary relationship between the window size used for pitch **feature** extraction and that used for tempo or other **feature** extraction. These comb filters have resonant frequencies covering a range of valid pitches. Advantageously this includes frequencies from around 200Hz up to around 3500Hz, and the filters are spaced at intervals determined by the rate at which the original musical signal was **sampled**. The **sampled** signal is filtered through the filter bank, and the comb filter that has the greatest output power will have a resonant frequency corresponding to the... ...for pitch extraction which exists and other methods may be used.

Returning to Fig. 3, and considering the music input and **classification** process, when the piece of music 100 is input, it then undergoes **feature** extraction 304 after which the **features** are classified 306 and stored in **feature** database 308. Substantially in parallel with this process, the actual music piece itself 100 is stored in music database 302. Thus the piece of music 100 and the associated representative **features** are stored in two distinct but related databases 302 and 308 respectively. If the music is initially derived from an analogue source, it is first digitised before being input into the **feature** extraction process 304. The digitisation step may be implemented by way of a standard soundcard or, if the music is already in digital form, this... ...for 100. Thus, arbitrary digitization structures including the Musical Instrument Digital Interface (MIDI) format and others may be supported in the system. There are no **specific** requirements in **terms** of sampling rate, bits per **sample**, or channels, but it should be noted that if higher reproduction **quality** is desirable it is preferable to select an audio resolution close to that of a CD.

Fig. 14 depicts a generic **feature classification** process. Extracted **feature** signals 404, 408, 412, 416 and 418 (refer Fig. 4) are accumulated in process step 1404 as histograms over substantially the whole duration of the piece of music 100 resulting in an indicative **feature** output 1406 for each extracted **feature** signal. This output 1406 is stored in the **feature** database 308. By identifying the N highest tempos in the manner described in Figs. 5 and 6**spectral** centroid is advantageously used to describe the sharpness in a window. This can be accumulated as a histogram over substantially the full duration of the... ...a histogram describing the relative occurrence of each sharpness across substantially the whole duration of the piece of music 100 can be formed. Accumulation of **features** as histograms across substantially the entire duration of pieces of music yields a duration independent mechanism for **feature classification** suitable for search and comparison between pieces of music. This forms the foundation for **classification** in the music database system. The **spectral** centroid is advantageously used to describe the percussivity in a window. This can be accumulated as a histogram over substantially the full duration of the... ...forms which include, but are not limited to:

1. (1) a set of names of known pieces of music and a degree of similarity/dissimilarity **specified** by a conditional expression (shown underlined) for each piece (e.g. very much like "You can hear me in the harmony" by Harry Conick Jr., a little like "1812 Overture" by Tchaikovsky, and not at all like "Breathless" by Kenny G);

2. (2) a set of user **specified features** and a similarity/dissimilarity **specification** in the form of a conditional expression (e.g. something that has a tempo of around 120 beats per minute, and is mostly **loud**).

In Fig. 15, the music query 104, containing music identifiers and conditional expressions is input into the **feature** comparison process 312 (see Fig. 3). This process 312 includes the **feature** retrieval process 1502 which retrieves the **features** associated with the pieces of music named in the music query 104 from **feature** database 308. Next these retrieved **features** are passed to similarity comparison process 1504 which searches the **feature** database 308 for **features** satisfying the conditional expression contained in music query 104 as applied to the **features** associated with pieces of music named in music query 104. The results of this comparison are passed to the identifier retrieval process 1506 which retrieves the music identifiers of the pieces of music whose **features** satisfy the conditional expressions as applied to the identifiers **specified** in music query 104. These identifiers are passed to the music selection process 314 which enables the output of the desired music 106 and/or music identifiers 108 from music database 302 and **feature** database 308 respectively.

Fig. 16 describes a database query process where music **features** are supplied in the music query 104. The music query 104, containing music **features** and conditional expressions, is available at the query stage 104 and thus in this case the **feature** retrieval process 1502 is bypassed (see Fig. 15). Next these provided **features** are passed to the similarity comparison process 1604 which searches the **feature** database 308 for **features** satisfying the conditional expression contained in music query 104 as applied to the **features** provided in the music query 104. The results of this comparison are passed to the identifier retrieval process 1606 which retrieves the music identifiers of the pieces of music whose **features** satisfy the conditional expressions in relation to the identifiers **specified** in music query 104. These identifiers are passed to the music selection process 314 which ensures the output of the desired music 106 and/or music identifiers 108 from music database 302 and **feature** database 308 respectively.

Considering the process of **feature** comparison 312, a similarity comparison is performed between the **features** of music stored by the system in the **feature** database 308 which correspond to pieces of music 100 stored in music database 302, and **features** corresponding to the music query 104. Since a number of different **features** (and **feature** representations) exist in the **feature** database 308, the comparisons between corresponding **features** are advantageously performed differently for each **feature**, for example:

comparison between loudness **features** stored as histograms are made through the use of a histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal;

comparison between tempo **features** stored as histograms are accomplished by methods such as histogram difference, or comparison of a number of moments about the mean of each histogram or other methods that achieve the same goal,

comparison between pitch **features** stored as histograms are performed using a histogram difference, or a comparison of a number of moments about the mean of each histogram. Other methods for comparison of pitch **features** may also be used,

comparison between sharpness **features** stored as histograms are achieved through the use of methods such as histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal, and

comparison between percussivity **features** stored as histograms are achieved through the use of methods such as histogram difference, or comparison of a number of moments about the mean of each histogram, or other methods that achieve the same goal.

Once the comparison of each of the relevant **features** has been made, the overall degree of similarity is ascertained. A simple, yet effective way of determining this is through the use of a distance metric (also known as the Minkowski metric with r = 1), with each of the **feature** comparison results representing an individual difference along an orthogonal axis.

Fig. 17 illustrates a distance metric used to assess the similarity between two pieces of music where D is the distance between the two pieces of music 1708 and 1710 (only 3 **features** are shown for ease of representation). In this case, a smaller value of D represents a greater similarity. D is advantageously represented by: SQRT loudness... ...difference 2

Fig. 17 illustrates the distance between two pieces of music 1708, 1710, these pieces of music being defined in **terms** of three exemplary **features** namely pitch 1702, tempo 1704, and sharpness 1706. Distance D 1712 represents the distance between the pieces of music 1710 and 1708 when measured in this context.

The above method will be partially described for a **specific** query 104 namely "Find a piece of music similar to piece A", where the database contains pieces of music A, B, C, and D. This query 104 is of a **type** described in Fig. 15 where music identifiers (ie the name of the piece of music "A") and a conditional expression ("similar to") is provided in the **query** 104.

Each piece of **music** stored in the database is represented by a number of **features** that have been extracted when the pieces were classified and stored in the database. For the sake of simplicity the **example presented** is restricted to two **features**, namely tempo and sharpness, where both **features** are represented by simplified histograms.

The four music pieces to be considered are named A, B, C and D. Their corresponding **feature** histograms are illustrated in Figs. 18-21.

Fig. 18 illustrates a tempo histogram and a... ...of the time (1810) and a brightness of 44100 Hz (1806) for 80% of the time (1812). Figs. 19 - 21 **display similar features** for pieces of **music** B - D.

When the **query** is presented, the following sequence of operations is performed:

Comparison of the **features** of A and B

Comparison of the **features** of A and C

Comparison of the **features** of A and D

Selection of the music that is least distant from A

Since all **features** of the music in the database are preferably represented as histograms, comparisons between these **features** is based on a comparison between the histograms. Two methods that are useful in forming this comparison are the histogram difference, and the comparison of... ...and B in regard to tempo is: 0.5 - 0.33 + 0.5 - 0.33 + 0 - 0.33 2 = 0.335

where the number of **terms** in the numerator is determined by the number of histogram points being compared, and the denominator is determined by the fact that two histograms are... ...0.7 2 + 0.335 2 = 0.776

If we consider the histograms in Figs. 18-21 for the **features** extracted from the piece of music A, B, C and D:

Music A, tempo histogram:

Music A, sharpness histogram:

Music B, tempo histogram:

Music B... ...however, the other pieces of music in the database namely D, E, ..., K, ... would be assessed in order to establish which piece of music had **features** which could simultaneously satisfy the requirements of being at a minimum distance from A, a larger distance from B, and a maximum distance from C.

It is further possible to apply a weighting to each individual **feature** in order to bias the overall distance metric in some fashion (for example biasing in favour of tempo similarity rather than loudness similarity).

In considering similarity assessment on the basis of either the histogram difference, or the comparison of moments, these being applied to the **attributes** of pitch, loudness, tempo, and timbre (i.e. sharpness and percussivity), it is found that two-pass assessment provides better **classification** results in some cases. The two-pass assessment process performs a first assessment on the basis of loudness, percussivity and sharpness, and then a second sorting process based on tempo. In the present embodiments, it is found that the **feature** of pitch may be omitted from the similarity assessment process without significantly degrading the overall similarity assessment results.

In considering similarity assessment using the comparison of moments process, good results are produced by selecting particular moments for each **feature** as shown in the following table: where "mean" and "variance" are determined in accordance with the following general form which expresses moments about the mean... ...the peak, and represents the relative strength of the dominant tempo.

Application of clustering techniques to a complete set of moments corresponding to the extracted **features**, including the mode of each histogram, provides better **classification** results in some cases. Use of Bayesian estimation produces a "best" set of classes by which a given dataset may be classified.

features from a music signal, said **features** including, for instance, tempo, loudness, pitch, and timbre, (ii) **classification** of music using extracted **features**, and (iii) method of querying a music database. Corresponding systems upon which the above method steps may be practised may be implemented as described by...

Claims: ...A method for querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to one or more **parameters**, the method comprising the steps of:

(a) forming a request which **specifies** one or more pieces of music and/or associated **parameters** and one or more conditional expressions;

(b) determining associated **parameters** for the **specified** pieces of music if the **parameters** have not been **specified** ;

(c) comparing the **specified parameters** and corresponding **parameters** associated with other pieces of music in the database;

(d) calculating a distance based on the comparisons; and

(e) identifying pieces of music which are at distances from the **specified** pieces of music as to satisfy the conditional expressions.

2. A method according to claim 1, including the further steps of:

(f) outputting at least... ...pieces are in a class of the plurality of pieces of music in the database.

6. A method according to any preceding claim, whereby a **classification** according to which the pieces of music are indexed uses **feature** extraction, the method further comprising the steps of:

(g) segmenting a piece of music over time into a plurality of windows;

(h) extracting one or more **features** in each of said windows; and

(i) arranging the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

7. A method according to claim 6, whereby a first **feature** extracted in step (h) is at least one tempo extracted from a digitised music signal, the **feature** extraction comprising the further sub-steps of:

(ha) segmenting the music signal into a plurality of windows;

(hb) determining values indicative of the energy in... ...the onset signal is formed in sub-step (hd) according to the further sub-sub-steps of:

(hdc) sampling the energy signal;

(hdd) comparing consecutive **samples** to determine a positive peak; and

(hde) generating a single pulse when each positive peak is detected.

12. A method according to any of claims... ...wherein the filter process resonant frequencies span a frequency range substantially between 1Hz and 4Hz.

13. A method according to claim 6, whereby a second **feature** extracted in step (h) is a percussivity of a signal, the method comprising the sub-steps of:

(hh) segmenting the signal into a plurality of... ...An apparatus for querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to one or more **parameters** the apparatus comprising:

(a) a request means for forming a request which **specifies** one or more pieces of music and/or associated **parameters** and one or more conditional expressions;

(b) a **parameter** determination means for determining associated **parameters** for the **specified** pieces of music if the **parameters** have not been **specified** ;

(c) a comparison means for comparing the **specified parameters** and corresponding **parameters** associated with other pieces of music in the database;

(d) a distance determination means for calculating a distance based on the comparisons; and

(e) a determination means for identifying pieces of music which are at distances from the **specified** pieces of music as to satisfy the conditional expressions.

19. An apparatus according to claim 18, wherein the apparatus further comprises:

(f) an output means... ...means for clustering the pieces of music in the database into classes.

22. An apparatus according to any of claims 18 to 21, whereby a **classification** according to which the pieces of music are indexed uses **feature** extraction means, the means comprising:

(g) segmentation means for segmenting an entire piece of music over time into a plurality of windows;

(h) **feature** extraction means for extracting one or more **features** in each of said windows; and

(i) histogram determination means for arranging the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

23. An apparatus method according to claim 22, whereby a first **feature** extracted in step (h) is at least one tempo extracted from a digitised music signal, and wherein the **feature** extraction means comprise:

(ha) segmentation means for segmenting the music signal into a plurality of windows;

(hb) energy determination means for determining values indicative of... ...wherein the onset signal generation means in sub-step (hd) comprise:

(hdc) sampling means for sampling the energy signal;

(hdd) comparator means for comparing consecutive **samples** to determine a positive peak; and

(hde) pulse generation means for generating a single pulse when each positive peak is detected.

28. An apparatus according... ...the comb filter means resonant frequencies span a frequency range substantially between 1Hz and 4Hz.

29. An apparatus according to claim 22, whereby a second **feature** extracted in step (h) is a percussivity of a signal, and wherein the **feature** extraction means comprise:

(hh) segmentation means for segmenting the signal into a plurality of windows, and for each window;

(hi) filtering means for filtering by... ...program product for querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to one or more **parameters** said computer program product comprising:

(a) a request means for forming a request which **specifies** one or more pieces of music and/or associated **parameters** and one or more conditional expressions;

(b) a **parameter** determination means for determining associated **parameters** for the **specified** pieces of music if the **parameters** have not been **specified**;

(c) a comparison means for comparing the **specified parameters** and corresponding **parameters** associated with other pieces of music in the database;

(d) a distance determination means for calculating a distance based on the comparisons; and

(e) a determination means for identifying pieces of music which are at distances from the **specified** pieces of music as to satisfy the conditional expressions.

35. A computer readable medium according to claim 34 said computer program product comprising:

(f) an... ...clustering the pieces of music in the database into classes.

38. A computer readable medium according to any of claims 34 to 37, whereby a **classification** according to which the pieces of music are indexed uses **feature** extraction means, said computer program product comprising:

(g) segmentation means for segmenting an entire piece of music over time into a plurality of windows;

(h) **feature** extraction means for extracting one or more **features** in each of said windows; and

(i) histogram determination means for arranging the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

39. A computer readable medium method according to claim 38, whereby a first **feature** extracted in step (h) is at least one tempo extracted from a digitised music signal, and wherein said computer program product comprising:

(ha) segmentation means... ...to the onset signal generation means in sub-step (hd) comprises:

(hdc) sampling means for sampling the energy signal;

(hdd) comparator means for comparing consecutive **samples** to determine a positive peak; and

(hde) pulse generation means for generating a single pulse when each positive peak is detected.

44. A computer readable... ...filter means resonant frequencies spaning a frequency range substantially between 1Hz and 4Hz.

45. A computer readable medium according to claim 38, whereby a second **feature** extracted in step (h) is a percussivity of a signal, and wherein said computer program product relating to the **feature** extraction means comprise:

(hh) segmentation means for segmenting the signal into a plurality of windows, and for each window;

(hi) filtering means for filtering by... ...music, the method comprising the steps of:

receiving a user request for one or more pieces of music from the database;

generating one or more **features** representative of the **style** of the requested one or more pieces of music;

determining one or more **features** representative of the **style** of each piece of music in said database, if those **features** have not already been determined,

comparing the one or more **features** representative of the **style** of the pieces of music in the database with the one or more **features** representative of the one or more pieces of music requested by said request; and

identifying one or more piece of music from said database in...

Claims: ...method of querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of their **features**, wherein said **features** comprise loudness, percussivity, tempo, pitch and sharpness, wherein each of the **features** of a piece of music is represented as a histogram describing the relative occurrence of each respective **feature** value across substantially the whole duration of said piece of music, the method comprising the steps of:a) obtaining a query (104) that contains the name of a piece of music and a degree of similarity, **specified** by a

conditional expression, for the named piece; b) retrieving (1502) the **features**, according to which the piece of music named in the query (104) is indexed, from the database; c) comparing each of the **features** retrieved in the retrieving step and the corresponding **features** of the pieces of music in the database (308), comprising calculating, for each of the **features** , a histogram difference or a difference of a number of moments of each histogram; d) calculating a distance representing an overall degree of similarity between the named piece of music and the pieces of music in the database based on the calculated difference for each of the **features**; and e) identifying (314) pieces of music in the database based on the distance calculated in the calculating step as to satisfy the conditional expression... ...method of querying a music database, which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of their **features**, wherein said **features** comprise loudness, percussivity, tempo, pitch and sharpness, wherein each of the **features** of a piece of music is represented as a histogram describing the relative occurrence of each respective **feature** value across substantially the whole duration of said piece of music, the method comprising the steps of:a) obtaining a query (104) that contains at least one **feature** and a degree of similarity, **specified** by a conditional expression, for said at least one **feature** of the piece of music; b) comparing each of said at least one **feature** in the query and the corresponding **features** of the pieces of music in the database (308), comprising calculating, for each of the **features**, a histogram difference or a difference of a number of moments of each histogram; c) calculating a distance representing an overall degree of similarity between all of said **features** in the query and all of the **features** of pieces of music in the database (308) based on the calculated difference for each of the **features**; and d) identifying (314) pieces of music in the database based on the distance calculated in the calculating step as to satisfy the conditional expression contained in the query.

3. A method according to claim 1 or 2, wherein a **classification** according to which the pieces of music are indexed uses **feature** extraction, the method further comprising the steps of;segmenting (502) a piece of music over time into a plurality of windows;

extracting (402, 406, 410, 414) one or more **features** in each of said windows; and
arranging (1404) the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

4. A method according to clam 3, wherein a first **feature** extracted in the extracting step is at least one tempo (402) extracted from a digitised music signal, the **feature** extraction comprising the further sub-step of:segmenting (502) the music signal into a plurality of windows;

determining (504, 608) values indicative of the energy... ...6, wherein the onset signal is generated in generating sub-step according to the further sub-sub-steps of:sampling the energy signal;
comparing consecutive **samples** to determine a positive peak; and
generating a single pulse when each positive peak is detected.

9. A method according to any of claims 4... ...wherein the filter process resonant frequencies span a frequency range substantially between 1Hz and 4Hz.

10. A method according to claim 4, wherein a second **feature** extracted in the extracting step is a percussivity of a signal, the method comprising the sub-steps of:segmenting (710) the signal into a plurality... ...of the gradient.

11. A method according to claim 10, wherein the segmentation in the segmenting sub-step of the extracting step of the second **feature** comprises the further sub-steps of:selecting a window width (708);

selecting a window overlap extent (776); and
segmenting the signal into windows each window... ...for querying a music database (302), which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of their **features**, wherein said **features** comprise loudness, percussivity, tempo, pitch and sharpness, wherein each of the **features** of a piece of music is represented as a histogram describing the relative occurrence of each respective **feature** value across substantially the whole duration of said piece of music, the apparatus comprising:a) obtaining means for obtaining a query (104) that contains the name of a piece of music and a degree of similarity, **specified** by a conditional expression, for the named piece;
b) retrieving means for retrieving (1502) the **features**, according to which the piece of music named in the query (104) is indexed, from the database;
c) comparison means for comparing each of the **features** retrieved by the retrieving means and the corresponding **features** of the pieces of music in the database (308), said comparing comprising calculating, for each of the **features**, a histogram difference or a difference of a number of moments of each histogram;
d) calculating means for calculating a distance representing an overall degree of similarity between the named piece of music and the pieces of music in the database based on the calculated difference for each of the **features**; and
e) determination means (314) for identifying pieces of music in the database based on the distances calculated by the calculating means as to satisfy... ...for querying a music database (302), which contains a plurality of pieces of music wherein the pieces are indexed according to a plurality of their **features**, wherein said **features** comprise loudness, percussivity, tempo, pitch and sharpness, wherein each of the **features** of a piece of music is represented as a histogram describing the relative occurrence of each respective **feature** value across substantially the whole duration of said piece of music, the apparatus comprising:a) obtaining means for obtaining a query (104) that contains at least one **feature** and a degree of similarity, **specified** by a conditional expression, for said at least one **feature** of the piece of music;
b) comparison means for comparing each of said at least one **feature** in the query and the corresponding **features** of the pieces of music in the database (308), said comparing comprising calculating, for each of the **features**, a histogram difference or a difference of a number of moments of each histogram;
c) calculating means for calculating a distance representing an overall degree of similarity between all of said **features** in the query and all of the **features** of pieces of music in the database (308) based on the calculated difference for each of the **features**; and
d) determination means (314) for identifying pieces of music in the database based on the distances calculated by the calculating means as to satisfy the conditional expression contained in the query.

14. An apparatus according to claim 12 or 13, wherein a **classification** according to which the pieces of music are indexed uses **feature** extraction means comprising;segmentation means (502) for segmenting an entire piece of music over time into a plurality of windows;

feature extracting means (402, 406, 410, 414) for extracting one or more **features** in each of said windows; and
histogram determination means for (1404) arranging the **features** in histograms wherein the histograms are representative of the **features** over the entire piece of music.

15. An apparatus according to claim 14, wherein a first **feature** extracted by said **feature** extraction means is at least one tempo extracted from a digitised music signal, and wherein the **feature** extraction means comprises:segmentation means (502) for segmenting the music signal into a plurality of windows;

energy determination means (504, 608) for determining values indicative... ...any of claims 15 to 17, wherein the onset signal generating means comprises:sampling means for sampling the energy signal; comparator means for comparing consecutive **samples** to determine a positive peak; and
pulse generating means for generating a single pulse when each positive peak is detected.

20. An apparatus according to...

Claims: ...procede comprenant les etapes consistant a :a) obtenir une requete (104) qui contient le nom d'un morceau de musique et un degre de ressemblance, **specifie** par une expression conditionnelle, pour le morceau nomme ; b) extraire (1502) de la base de donnees les caracteristiques en fonction desquelles le morceau de musique... ...de musique, le procede comprenant les etapes consistant a :a) obtenir une requete (104) qui contient au moins une caracteristique et un degre de ressemblance, **specifiee** par une expression conditionnelle, pour ladite au moins une caracteristique du morceau de musique ; b) comparer chacune de ladite au moins une caracteristique contenue dans ... ...l'etape de calcul pour satisfaire a l'expression conditionnelle contenue dans la requete.

3. Procede selon la revendication 1 ou 2, dans lequel la **classification** selon laquelle les morceaux de musique sont indexes utilise une extraction de caracteristiques, le procede comprenant en outre les etapes consistant a :segmenter (502) un... ...comprenant :a) un moyen d'obtention pour obtenir une requete (104) qui contient le nom d'un morceau de musique et un degre de ressemblance, **specifie** par une expression conditionnelle, pour le morceau nomme ;

b) un moyen d'extraction pour extraire (1502) de la base de donnees les caracteristiques en conformite... ...musique, l'appareil comprenant :a) un moyen d'obtention pour obtenir une requete (104) qui contient au moins une caracteristique et un degre de ressemblance, **specifiee** par une expression conditionnelle, pour ladite au moins une caracteristique du morceau de musique ;
b) un moyen de comparaison pour comparer chacune de ladite au... ...de calcul de facon a satisfaire a l'expression conditionnelle contenue dans la requete.

14. Appareil selon la revendication 12 ou 13, dans lequel une **classification** selon laquelle les morceaux de musique sont indexes utilise un moyen d'extraction de caracteristiques comprenant :un moyen de segmentation (502) pour segmenter la totalite ...

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DIALOG(R)File 348: EUROPEAN PATENTS

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17/3K/5 (Item 5 from file: 348)
00945532

Memory control in recording and/or reproducing apparatus
Steuerung eines Speichers in einem Aufzeichnungs- und/oder Wiedergabegerat
Commande de memoire dans un appareil d'enregistrement et/ou de reproduction

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CLAIMS A	(English)	199833	399
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CLAIMS B	(English)	200349	400
CLAIMS B	(German)	200349	301
CLAIMS B	(French)	200349	530
SPEC B	(English)	200349	11297
Total Word Count (Document A) 11716			
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Specification: ...recording and/or reproducing apparatus capable of recording and/or reproducing data organized in programs (such as audio data, musical pieces, etc.), on a disc-**type** recording medium for example. This invention further relates to an address generating circuit provided in the memory control device.

There have been known data re... ...the basis of a pre-mastered TOC (hereinafter referred to as "P-TOC"). The P-TOC comprises managing information formed as pit data.

One known **type** of disc media is a pre-mastered disc medium in which programs (such as musical pieces, etc.) are recorded as pit information. This **type** of disk medium is exclusively used for reproduction. The rewriting of the managing information is not required for this pre-mastered **type** of disk, and the area management of the programs is carried out solely on the basis of the P-TOC.

Generally, for a recordable disc... ...a disc medium it is not generally necessary to record a program (such as a musical piece) on a continuous segment. Note that in this **specification**, the term "segment" is defined as a track portion on which physically-continuous data is recorded. That is, no problem would occur if the program... ...programs are not limited to programs, and any program corresponding to an audio signal may be so recorded. For the sake of brevity, in this **specification**, any lump of data (a recording data unit) which has a linked content in combination may hereinafter be referred to as a "program".

Of course, when the recording operation is carried out for the above **type** of disc medium, the audio recording operation must be continuously carried out while accessing plural segments serving as recordable areas, and when the reproducing operation... ...in Fig. 2, the sectors are further divided into sound groups. Each unit of two sectors is divided into 11 sound groups. Data of 512 **samples** are recorded in an audio group while being separated into left (L) and right (R) channels. One sound group has an audio data whose time... ...amount to be communicated is increased.

In the course of the recording/erasing operation of programs (such as musical pieces or the like) for this **type** of disc medium, there may occur a vain area (also called a trash area) which is not managed by the U-TOC havingthe managing mode...In Fig. 5, a reference numeral 1 represents a magneto-optical disc

on which audio data or the like is recorded, and it is rotationally **driven** by a spindle motor 2. A reference numeral 3 represents an optical head for irradiating laser beam onto the magneto-optical disc 1 in recording... ...information and the focus monitor signal are supplied to a system controller 11 comprising a microcomputer.

The servo circuit 9 generates various kinds of servo **driving** signals on the basis of the supplied tracking error signal and focus error signal, and an auto music sensor instruction, a seek instruction, a rotational... ...decoder unit 8, the data is subjected to an encode processing such as CIRC encode, EFM modulation, etc., and then supplied to a magnetic head **driving** circuit 15.

The magnetic head **driving** circuit 15 supplies the magnetic head 6 with a magnetic head drive signal in accordance with the recording data which has been subjected to the... ...operation input unit provided with keys which are manipulated by an user, and a reference numeral 20 represents a display unit comprising a liquid crystal **display**, for **example**. The operation input unit 19 is provided with a sound-recording key, a reproducing key, a stop key, an AMS (auto **music** sensor) key, a **search** key, etc. for the user's manipulation.

When the recording/reproducing operation is conducted on the disc 1, managing information recorded on the disc 1... ...4 is provided for the P-TOC. A sector 1 and subsequent sectors are optional, and the use of these sectors is dependent on the **type** of the apparatus.

The data area for the sector of the P-TOC comprises 4 bytes X 588 (=2352 bytes). At the head position of... ...header, an identification ID (ASCII code corresponding to the letters "MINI") is added at a predetermined address position.

Further subsequently thereto are recorded a disc **type**, a sound recording level, the number of a first recorded program (such as a program, the First TNO as shown in Fig. 6), the number... ...and mode information (track mode) for the segment (track) are recorded.

The mode information for the track in each part table are recorded information indicating **characteristics** such as whether the segment is set to an over-write inhibition or data copy inhibition mode, information indicating whether it is audio information, an... ...TOC sector 0 is recorded in a table pointer (P-TNOI) through a prescribed calculation processing. In this format, the address of a part table **specified** by the calculation of (76 X 4) + ((Px) X 8) is indicated in each table pointer (P-TNO1 to P-TNO255).

Accordingly, when a part... ...the P-TOC (these are managed by U-TOC as described later), and thus all the bytes are set to "00h".

However, for a hybrid **type** of disc having both of ROM area and magneto-optical area on which audio data, etc. are recorded, the audio data in the ROM area... ...at the subsequent 6 bits and a sound group address at the lower 4 bits, as shown in Table 8B.

As described above, in this **type** of recording and reproducing apparatus, even when a program is recorded in a physically discontinuous manner, that is, it is recorded over plural segments, the...

Specification: ...B1

This invention relates to a memory control device for use... ...recording and/or reproducing apparatus capable of recording and/or reproducing data organized in programs (such as audio data, musical pieces, etc.), on a disc-**type** recording medium for example. This invention further relates to an address generating circuit provided in the memory control device.

There have been known data re... ...data is used to locate an area on which a program to be reproduced is recorded. The device then accesses the area to carry out **a** reproducing operation for the program.

In such disc media, the area management on the disc and the position management of the U-TOC **are** carried out on the basis of a pre-mastered TOC (hereinafter referred to as "P-TOC"). The P-TOC comprises managing **information** formed as pit data.

One known **type** of disc media is a pre-mastered disc medium in which programs (such as musical pieces, etc.) are recorded as pit information. This **type** of disk medium is exclusively used for reproduction. The rewriting of the managing information is not required for this pre-mastered **type** of disk, and the area management of the programs is carried out solely on the basis of the P-TOC.

Generally, for a recordable disc medium, such as a magneto-optical disc (MO disc) or the like, random access can be **more** easily carried out as compared to a tape recording medium formed as a tape, such as a compact cassette tape or the like. Furthermore, when... ...a disc medium it is not generally necessary to record a program (such as a musical piece) on a continuous segment. Note that in this **specification**, the term "segment" is defined as a track portion on which physically-continuous data is recorded. That is, no problem would occur if the program... ...the difference between time periods of programs to be recorded and time periods of previously erased programs. Through the above discrete recording operation, any program **which** is longer than a previously erased program can be recorded using the erased portion, and thus the data recording area can be effectively used. Note that recordable programs are not limited to programs, and any **program** corresponding to an audio signal may be so recorded. For the sake of brevity, in this **specification**, any lump of data (a recording data unit) which has a linked content in combination may hereinafter be referred to as a "program".

Of course, when the recording operation is carried out for the above **type** of disc medium, the audio recording operation must be continuously carried out while accessing plural segments serving as recordable areas, and when the reproducing operation... ...has a length corresponding to two or three rounds of the disc. An address is recorded for every sector. The sub data area of 4 **sectors** is used for sub data or as a link area. TOC data, audio data, etc. are recorded in the main data area of 32 sectors... ...in Fig. 2, the sectors are further divided into sound groups. Each unit of two sectors is divided into 11 sound groups. Data of 512 **samples** are recorded in an audio group while being separated into left (L) and right (R) channels. One sound group has an audio data whose time... ...as the read-out executing command must be output to the memory controller, and thus more time is required for the data communication. Particularly in **the** case where the memory controller and the system controller carry out the data reception and transmission through a serial communication, the processing time increases as... ...amount to be communicated is increased.

In the course of the recording/erasing operation of programs (such as musical pieces or the like) for this **type** of disc medium, there may occur a vain area (also called a trash area) which is not managed by the U-TOC having the managing... ...embodiment relates to a memory control device for a recording and/or reproducing apparatus in which a magneto-optical disc is used as a recording **medium**, and an address generating circuit provided in the memory control device.

Fig. 5 is a block diagram showing the main part of the recording and... ...In Fig. 5, a reference numeral 1 represents a magneto-optical disc on which audio data or the like is recorded, and it is rotationally **driven** by a spindle motor 2. A reference numeral 3 represents an optical head for irradiating laser beam onto the magneto-optical disc 1 in recording...disc 1), an address information, a focus monitor signal, etc. The extracted reproduction RF signal is supplied to an encoder/decoder unit 8. The tracking **error** signal and the focus error signal are supplied to a servo circuit 9, and the address information is supplied to an address decoder 10. The... ...information and the focus monitor signal are supplied to a system controller 11 comprising a microcomputer.

The servo circuit 9 generates various kinds of servo **driving** signals on the basis of the supplied tracking error signal and focus error signal, and an auto music sensor instruction, a seek instruction, a rotational... ...14 to be subjected to the audio compression encode processing. The recording data compressed by the encoder/decoder unit 14 is temporarily written in the **buffer** RAM 13 by the memory **controller** 12, and then read out at a prescribed timing to be transmitted to the encoder/decoder unit 8. In the encoder/decoder unit 8, the data is subjected to an encode processing such as CIRC encode, EFM modulation, etc., and then supplied to a magnetic head **driving** circuit 15.

The magnetic head **driving** circuit 15 supplies the magnetic head 6 with a magnetic head drive signal in accordance with the recording data which has been subjected to the... ...of N or S magnetic field to the magneto-optical disc 1 by the magnetic head 6 is executed. At this time, the system controller **11** supplies **a** control signal to the optical head 3 to output a laser beam having the proper power level for recording.

A reference **numeral** 19 represents an **operation** input unit provided with keys which are manipulated by an user, and a reference numeral 20 represents a display unit comprising a liquid crystal **display**, for **example**. The operation input unit 19 is provided with a sound-recording key, a reproducing key, a stop key, an AMS (auto **music** sensor) key, a **search** key, etc. for the user's manipulation.

When the recording/reproducing operation is conducted on the disc 1, managing information recorded on the disc 1... ...is shown in Fig. 6.

Fig. 6 shows one segment (sector 0) for P-TOC information which is repetitively recorded in an area used for **P** -TOC (for example, in a ROM area at the innermost peripheral side of the disc). An area of five sectors from a sector 0 to... ...4 is provided for the P-TOC. A sector 1 and subsequent sectors are optional, and the use of these sectors is dependent on the **type** of the apparatus.

The data area for the sector of the P-TOC comprises 4 bytes X 588 (=2352 bytes). At the head position of this data area there is provided a header with a sync pattern of one **byte** data for all "0" or all "1", and addresses representing a cluster address and a sector address, etc., thereby indicating the P-TOC area.

Subsequently... ...header, an identification ID (ASCII code corresponding to the letters "MINI") is added at a predetermined address position.

Further subsequently thereto are recorded a disc **type**, a sound recording level, the number of a first recorded program (such as a program, the First TNO as shown in Fig. 6), the number... ...TNO1 to P-TNO255) in the corresponding table indicating data portion (the numerical value affixed with "h" are represented by hexadecimal notation). Each of the **part** table is so designed that a start address serving as a starting point for a segment, an end address serving as an end point for... ...and mode information (track mode) for the segment (track) are recorded.

The mode information for the track in each part table are recorded information indicating **characteristics** such as whether the segment is set to an over-write inhibition or data copy inhibition mode, information indicating whether it is audio information, an... ...the end address becomes an end address for the recording position of the data of the first program. Further, the track mode information becomes information **for** the first program.

The above described addresses are stored using a numerical value with which a part table is indicated at a byte position in... ...TOC sector 0 is recorded in a table pointer (P-TNO1) through a prescribed calculation processing. In this format, the address of a part table **specified** by the calculation of (76 X 4) + ((Px) X 8) is indicated in each table pointer (P-TNO1 to P-TNO255).

Accordingly, when a part... ...By forming the P-TOC sector 0 as described above, a predetermined program can be accessed and reproduced, for example.

For a recordable/reproducible magneto-**optical** disc which has no pre-mastered audio data area, the corresponding table indicating data portion and the managing table portion as described above are not... ...the P-TOC (these are managed by U-TOC as described later), and thus all the bytes are set to "00h".

However, for a hybrid **type** of disc having both of ROM area and magneto-optical area on which audio data, etc. are recorded, the audio data in the ROM area... ...is designed so that each part table can contain link information for indicating a part table in which the start and end addresses for a **linked** segment.

The start address/end address of 24 bits (3 bytes) in these part tables comprises a cluster address at the upper 14 bits, a... ...at the subsequent 6 bits and a sound group address at the lower 4 bits, as shown in Table 8B.

As described above, in this **type** of recording and reproducing apparatus, even when a program is recorded in a physically discontinuous manner, that is, it is recorded over plural segments, the...

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AUDIO REQUEST INTERACTION SYSTEM
SYSTEME INTERACTIF POUR DEMANDE DE PRODUITS AUDIO

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Claims:

...sale device is disclosed in U.S. Patent No. 5,408,077, but purchases are limited, and it does not address the need for other **types** of interaction. Both of these devices address only the purchase aspect of the user experience. It would be desirable to provide a system and method... ...controls its delivery to the person who initiated the request. It is to be understood that both the foregoing general description and the following
0**detailed** description are exemplary and explanatory only and are not restrictive of the invention, as claimed.BRIEF DESCRIPTION OF THE DRAWINGSThe accompanying drawings illustrate one... ...a method for selling a consumer a product or service related to audio programming to which the consumer is listening at the time of purchase.**DETAILED** DESCRIPTIONThe following is a description of an exemplary embodiment of the invention in which a person who is listening to audio, such as a... ...As noted above, the term "content" as used herein refers to the substance of the transmitted audio, such as a song or an advertisement or **other offer**. As illustrated in Fig. 1, a consumer IO listens to radio programming broadcast from a remote broadcaster 12 to a conventional radio receiver 14 in... ...to broadcaster 12. For example, the content can be songs that are provided in the form of audio recordings. Content can also include advertisements and **other offers**. Consumer IO uses a device 1 8 to initiate

requests that relate to the content. For example, if consumer 10 is listening to a **song**, he or she can **request** a copy of the recording. If consumer 10 is listening to an advertisement for a product or service, he or she can request the product... ...20 can be, for example, an entity that operates what is referred to herein as a processor host service (PHS). As described below in further **detail**, the PHS responds to the request received from device 18 by identifying a product, service or other deliverable relating to the request and delivering it... ...or mounted on a dashboard or other area of a vehicle (not shown) within reach of the driver. Consumer 10 can thus initiate requests while **driving** and listening to the radio. As illustrated in Fig. 2, device 18 includes a housing 22, a microphone 24 that picks up the audio from...or other electron'1 1 ICdevice, such as a cellular telephone or computer. Power cord assembly 32 is a multifunctional assembly described in further **detail** below, and has a plug (not shown) that fits into a vehicle's cigarette lighter (or alternative 12 volt power connection). Alternatively to receiving power... ...and button 26 can be actuated using only a single hand. RECORD button 28 is referred to by that name because, as described in further **detail** below, pressing it causes device 18 to store the most recent recording of the broadcast audio. Indicator lamp 30 can be a tricolor light-emitting... ...between the device and the broadcast signal. As illustrated in Fig. 3, device 18 further includes a working memory or main memory 34, a recorded **sample** memory 36, a transaction queue memory 38, non-volatile memory 40, a processor 42, a real-time clock 44, a speaker 46, a frequency-modulation... ...similar devices. Because such programming concerns are matters of design choice well-understood to persons skilled in the art, they are not described in further **detail** herein. In view of the description of the operation of device 18, such persons will readily be capable of suitably programming processor 42 to perform... ...is sufficient to enable it to be identified, either by automated means or by a human analyst employed by the PHS, as described in further **detail** below. In the illustrated embodiment, in which the content is commercial radio programming such as music and advertisements, an interval of five to ten seconds may be sufficient to identify the content. While the audio is being **sampled** as described above, in accordance with tuner task 44 processor 42 causes FM radio receiver 48 to scan or sequentially tune common broadcast frequencies and...the broadcast frequency, or zero filled frequency field if the frequency isindeterminate;
4 the serial number of device 18; and

5 the digitized audio **sample** itself. Processor 42 also initiates a security check of the **type** commonly performed in wireless data network transactions. Once the security check is satisfied, processor 42 encrypts the transaction record and causes it to be transmitted... ...may hear a song and want to order it, but choose to submit the request at a later time. For example, perhaps consumer IO has **driven** out of the local WAN range and wishes to avoid additional service charges for contact at this time. To prevent the audio recording from being... ...continuous FIFO process, consumer IO can press 1 5 RECORD button 28. When RECORD button 28 is pressed, the device moves the most recent audio **sample** to a different, reserved area of memory where it will not be overwritten. This audio request will be submitted when consumer 1 0 next presses... ...to the frequency of the station broadcasting that audio. To isolate the broadcasting station's frequency, processor 42 in accordance with tuner task 54 continuously **samples** the audio frequency by analyzing input from microphone 24. At the same time, it continuously alters the frequency of FM receiver 48 until the frequency...the above, in other embodiments of the invention the consumeroperated device can be equipped with a variety of combinations of other buttons for various other **types** of interactive purposes. For example, an INFO button (not shown) can be included, whereby the user can request information about the product or service being... ...the service.) Before use, the PHS stores a consumer profile and configures device I S. At this time, the PHS and consumer IO deten-nine **specifics** of the functionality of device 18. For example, instead of having the PHS configure real-time

clock 44, consumer IO can choose to have device 18 programmed to **sample** readings from the Global Positioning System (GPS) or receive signals from the National Time Standard broadcast. In alternative embodiments, consumer 10 may have purchased a... ...s area and the PHS's digital database of broadcasting can be established. In a particular embodiment, the process of identification can depend upon the **nature** of the request **sample** submitted. If the data are sent as a digital hash recorded at the time of purchase, for example, the PHS can perform a statistical or... ...This analysis can be performed using speech recognition technologies, speaker identification systems, or other technologies that perform data analysis. As an alternative to companing the **sample** with those in the database, technicians employed with the PHS can manually review the **sample** and determine a match with the appropriate broadcast program segment. One of the central **features** of the device is its ability to communicate quickly and effectively with the server at the PHS. This aspect makes the invention easy to update... ...will also vary with alternative embodiments in which the request identification process differs. For example, in the case where the device produces a digital hash **sample** rather than a recording of microphone input, processor 42 would not produce recordings in the same way. Alternative means of sampling would be particularly desirable... ...technology (slower modems or phone lines) or expensive communication lines (long distance or out-of-network wireless systems). In still other embodiments, a user can **specify** requests through manual entry of a broadcast station frequency. In such embodiments the device can, for example, include a CHANNEL button for selecting a frequency... enters the channel infonnation and presses a BUY button. The PHS uses the channel information, time, and date to identif@ the request. Depending upon the **specific** design of the device and the **nature** of the request IDtransmission, the PHS may analyze and process the request differently. Figure 7 illustrates the elements of a suitable PHS. Figure 8... ...data in the transaction record, at step 77 the PHS identifies the request based upon the broadcast content at that time. For example, a purchase **request** for **music** results in identification of the artist, song, and album. Database 82 can be maintained and updated by the broadcaster or other broadcast schedule maintenance organization ... ...research organization 90, which is an organization of people or technolocrgywhereby the transaction request is identified. For example, in the case of a **music** purchase **request** that cannot be electronically identified without human intervention, research organization 90 would employ multimedia computer ten-ninals with which one or more technicians listens to the recorded audio **sample** and attempts to identify it. Research organization 90 may be composed of experts from various music-related sectors. In embodiments of the invention in which the deliverables that can be **requested** are not related to **music**, the technicians or other personnel can be experts in whatever fields are relevant to the deliverables. If the product, service or other deliverable can be... ...94 takes the completed purchase data and first perforins a final validation-matching step that compares the desired purchase with the 1 0 recorded audio **sample**. Through this comparison, shopping module 94 confinns the match between the identification data and the purchase request data. At step 79 shopping module 94 then with the e-commerce merchant by interacting with the site on which the item is found. If the consumer's profile **specifies** conventional mail or similar form of physical delivery (or if the deliverable is not of a **nature** that can be delivered by electronic means). the merchant mails, ships or otherwise delivers it to consumer 10. In the illustrated embodiment, in which the deliverable is a music recording, if the consumer's profile **specifies** digital media as the preferred form of delivery, the PHS composes an e-mail message with an attachment of the music recording in MP3 or other suitable digital format. In the case of new releases of **popular** albums, likely that large numbers of purchase 'II be received for the same product. In such cases, block purchases of media canrequests wi I... ...s communication that the request has been fulfilled and is ready for delivery. The final steps of the interactive process will vary according to the **nature** of the interface on the particular consumer-operated device and the consequent range of prospective interactive requests. For example, if

an INFO button is included, the user may wish to activate it to obtain **samples** or additional information prior to making a purchase. Further information could take the form of a **sample**, such as a clip from an audiotape or a **sample** issue or trial size of the advertised product. In scenarios in which the audio content that is broadcast relates to community events, services, or groups... ...activate such an INFO button to obtain additional information about the content at the time. Delivery for the requested content will differ according to the **nature** of the content itself For example, the deliverable relating to an event or service can take the forin of an 1 0 admission ticket or discount coupon. As the system and method of interaction becomes more **popular**, programming could be adjusted to maximize the effectiveness of the invention for the broadcast station contributors. Broadcast companies, retailers, or advertisers may use inaudible 4... ...with the consumer. For example, via a WAN the retailer may access the consumer profile and, upon the activation of the device by the consumer, **offer suggestions** on **related** products or **specific** alternatives to the product to which the consumer responded. Consumer interactions could be sorted, compiled and sold or otherwise given to broadcasters and retailers for... ...the request process to a single step. To make a1Dpurchase or other request, the consumer merely has to click a button. Furthennore, the **nature** of the interaction goes beyond that of simply making a purchase. The invention allows consumers to initiate a range of requests, from soliciting information to... ...spontaneous consumer engagements restrict the application to narrow markets, such as purchasing music on the radio. This system and method enables impulsive buying of any **type** of item in any context. The invention also enables integration with other technology. This **feature** is intended for two purposes. First, the device can be physically combined with sources of broadcast media, such as a car radio or television. Both devices can share resources and **features**, making the request process more reliable and more efficient. Second, the invention may be combined with other technology to give the consumer even greater freedom... ...broadcast media. For example, the consumer can order a product while listening to its description on the radio, without the need to write down the **details** and obtain the item later. Nor does the consumer have to engage a multi-step process of entering a PIN or other information, which can be distracting and potentially dangerous when **driving** a car. With this one device, the consumer may respond to a community announcement, register for a local event, request a sales call by an... ...the scope or spirit of the invention. Other embodiments of the invention will be apparent to those skilled in the art from consideration of the **specification** and practice of the invention disclosed herein. It is intended that the **specification** and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.CLAIMSA method... ...including an identification element,said profile inforination stored at a host site remote from said person;id person initiating recording in said device of a **sample** of audible content tosal I I Iwhich said person is listening;1-@said person initiating transmission of a request from said device to said host site,id request including an electronic representati I Isa on of said **sample** and an identifieridentifying said user and matching said identification element, said requesting indicatingperson's desire to obtain a deliverable related to said content;sal I I I 1identifying said deliverable by analyzing said content in response receipt of saidIDelectronic representation of said **sample**; anddelivering said deliverable to said person.

5 The method of claim 4, wherein said step of said person initiating Intransmission of said request... ...representing content audible to saidperson;a request initiator operable by said person to initiate a request for adeliverable relating to said content;a **sampler** sampling said signal in response to initiation of said request byIperson;sala transmitter transmitting said request to said remote service in response...and, finding said record, initiatincr a remote connection to said processor host service and creating a communication record including request data and said recorded signal **sample**.

10 The system of claim 9. wherein said device further comprises:

a clock circuit;a radio receiver; andwherein said processor scans a predetermined range... ...FiGo 21/7@1 7MAIN MEMORY34 54TASKFM RADIO TASKRECEIVERTASK 5652ADCTASKSK5 60PROCESSORRECORDED **SAMPLE** MEMORY36 --@'TRANSACTIONQUEUEREAL-TIME MEMORYCLOCK 38NON-VOLATILE MEMORYRECORDBUTTON 40-@)BUYBUTTON46LED 53 FIGm 3CELLULARWAN I ... ...RESETPOWER SAMPLINGNOT SAMPLING REMOVED HISTORYLEDGREEN CHANGECHANGE LEDLED COLORPOWERREMOVED COLOR LEDYELLOW0/-XIVI r LrM RECEIVER**SAMPLE**MICROPHONEPOWERAPPLIEDFiGn 43/7POWERAPPLIEDPOWER YELLOWOFF REMOVEDUNELOSE@SSTATIONID TUNEROWER ID'SREMOVED IV STATION... ...SHOPPINGNOTIFICATION MODULEMODULET92 94FiGs 7CONSUMERREGISTERSWITH PHS66/ PHS, CONFIGURESDEVICECONSUMER CONSUMERSUBMITS RECORDSFORREQUEST LATER SUBMISSION70**SAMPLE** 10 PHS QUEUESRELAYED VIA **SAMPLE**WAN TO PHS 7572PHS IDENTIFIESREQUEST 77PHS FULFILLS 79FiGn 8 REQUESTPHS CONFIRMSREQUEST 81RESPONSE7/7On'ERNATIONAL SEARCH REPORT International application No.PCT[USOO/31510A. **CLASSIFICATION** OF SUBJECT MATTERIPC(7) :G06F 17/60US CL : 705/26According to International Patent **Classification** (IPQ or to both national **classification** and IPCB. FIELDS SEARCHEDMinimum documentation searched (**classification** system followed by **classification** symbols)U.S. : 705/1, 26, 27Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search **terms** used)EAST, DIALOG, NPL**search terms**: audio, sound, **music**, identification, recognitionC. DOCUMENTS CONSIDERED TO BE RELEVANTCategory* Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No.XqE... ...Hollywood Reporter; Nov. 1, 1999; vccclx, n 13, p 3Further documents are listed in the continuation of Box C. See patent family annex. **Special** categories of cited documents: -T- later document published after the international filing date or priority 'A' document defining the general state of the art which... ...on priority claim(s) or which is when the document is taken alone cited to establish the publication date of another citation or other Y. **special** reason (as **specified**) document of particular relevance; the claimed invention cannot beconsidered to involve an inventive step when the document isdocument referring to an oral disclosure...

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00786998

FINDING PERCEPTUALLY SIMILAR MUSIC WITH PRECOMPUTATION
RECHERCHE PAR CALCULS PRELIMINAIRES D'UNE MUSIQUE IDENTIQUE EN PERCEPTION

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English Abstract:

...a model of alikeness (105) which is based upon empirical observations of human perception of likeness between pairs of songs. The humans judge a representative **sample** of music (101) to build the model (105). Then other musical recordings (109) are applied to this system which extracts **parameters** (104) from the content of each recording and applies them to the model (105) to compute the differences between the **parameters** of the new recording and **parameters** developed for the model to place them in a data base of **parameter** differences (107). By allowing a user to select one of the recordings from the data base for which **parameters** have already been extracted, the system can efficiently work with a large number of recordings. A further efficiency improvement is achieved by precomputing differences between...

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FINDING PERCEPTUALLY SIMILAR MUSIC WITH PRECOMPUTATION
11.0113ACKGROUND
Modern computers have made possible the efficient assemblage and
searching of large databases of information. Text-based information can be searched for key words. Until recently... ...metadata associated with each recording rather than via the acoustical content of the music itself. The metadata includes information such as title, artist, duration, publisher, **classification** applied by publisher or others ("**genre**"), instrumentation, and recording methods. For several reasons, it is highly desirable to be able to search the content of the music to find music which... ...a particular song and want to find another that is similar. A second reason is that textual metadata tends to put music into classes or **genres**, and a search in one **genre** can limit the discovery of songs from other **genres** that may be attractive to a listener. Often the **genre** label is applied at the artist or album level, and this label may be inappropriate at the song level. Yet another reason is that searching... ...music allows searches when textual information is absent, inaccurate, or inconsistent.

A company called Muscle Fish LLC in Berkeley, California has developed
computer methods for **classification**, search and retrieval of all kinds of sound
recordings. These methods are based on computationally extracting many

c Lparameters" from each sound recording to develop a **vector**, containing a large number of data points, which **characteristically** describes or represents the sound.

These methods are described in a paper entitled **Classification**, Search, and Retrieval of Audio by Erling Wold, Thom Blum, Douglas Keislar, and James Wheaton
which is was published in September 1999 on the Muscle... ...Method and article of manufacture for content-based analysis, storage, retrieval, and
segmentation of audio information."
1
In the Blum system, a large number of **vectors**, each representing a brief
sound recording, is assembled in a data base. A user can **specify** ranges for each of the **parameters** to find within the data base a desired sound. Alternatively, the user can present to the system a new sound recording. The system then computes **parameters** for the recording, assembles the **parameters** into a **vector**, and then, by **vector** subtraction, computes the distance from the example sound recording to the previously stored sound recordings and presents to the user the sound recordings whose **vectors** are closest. Using this "query by example" method, a user can present a new sound to the data base and find other sounds within the data base that are similar.

2.0 SUMMARY OF THE INVENTION
The invention builds on the Blum method of extracting many **parameters** from each of many sound recordings and assembling them into a database. Like Blum, to build a database of sounds, a set of **parameters** is extracted from a large number of recordings. **Vectors** of the **parameters** (or "descriptors" derived from the **parameters** as **specified** in US patent application number 09/556,086 which is incorporated by reference) are assembled and compared by subtraction or by finding the correlation.

The... ...and allow humans to find desired musical recordings within a large database of musical recordings.

To perform "query by example", instead of receiving a new **sample** of sound and performing all of the necessary computations of **parameters** and **vector** differences, the system allows a user to select one of the sounds already within the data base as the query starting point. By starting with a sound already in the database, the **parameters** have already been computed, the **vector** has already been assembled, and the distances to other **vectors** have already been computed. This precomputation allows the improved system to operate much more quickly than the Blum system. With this improvement, the system becomes ... ...find, within a very large database of music, music which is similar to music they already know. Also, by using a recording for which the **parameters** have already been extracted, copies of the system can be distributed without including **parameter** extraction methods that should not be made available. Similar benefits are obtained if the system also includes precomputed **vector** comparisons so that **vector** difference computation methods can be kept confidential.

In one embodiment of the invention, a business entity performs computation of **parameters** for all musical recordings to which it can gain access and then widely
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distributes these **parameters**, with identifiers **specifying** the recordings, to large numbers of people and computer systems throughout the world. By precomputing and widely distributing the **parameters**,

others throughout the world will have the **parameters** to work with and will not need to compute the **parameters** themselves, and it provides a standardized computation of **parameters** to make them comparable from one recording to another. Others can then assemble sets of musical recording identifiers for which the **parameters** are available and use these selected sets to **specify** a search domain for finding music that is similar to a target musical recording where the **parameters** were also precomuted by the same original process. This will 1 0 allow the creativity of large numbers of people to be applied to selecting...first computation is made with one representative song from each cluster. In essence, the data base is "partitioned" into manageable sizes for computing differences between **vectors**.

As a further improvement, instead of simply computing simple **vector**
differences, the computation is adjusted with weightings to reflect a model of how humans perceive likeness between pairs of songs. One or more humans listen... ...10 matches per song and so some techniques for choosing those 1 0 matches is needed. The methods described use filters derived from the extracted **parameters**, combined with meta data from other sources.

3.0 BRIEF DESCRIPTION OF THE DRAWINGS
Figure 1 illustrates how the current invention is used to find music that humans perceive as sounding alike using weighted **parameters**.

Figure 2 illustrates how the current invention is used to find music that humans perceive as sounding alike using weighted descriptors.

Figure 3 illustrates a... ...illustrates a method for creating and searching a database.

Figure 5 is an example of an interface used to interact with a database.

4.0 **DETAILED** DESCRIPTION
4.1 Modeling likeness with **parameters** (Figure 1)
The invention is illustrated in Figure 1. A database of stored music 101 is played in pairs to one or more humans, step 102, who rate the music on likeness. In the preferred method, the same music is fed into a **parameter** extractor 103, that uses methods known in the art to extract **parameters** 104 that are relevant to the perception of music, such as tempo, rhythm complexity, rhythm strength, dynamic range, and harmonicity. Numerous different methods for extracting each of these **parameters** are known in the art. The model is refined, step 108, by minimizing the difference, calculated in step 106, between the human-derived likeness values and the model-derived values.

An alternative method uses humans to extract **parameters** that are relevant to the perception of music, such as tempo, rhythm complexity, rhythm strength, singer contribution, number of instruments, **type** of instruments, and voice timbre. This replaces the machine **parameter** extractor 103. The model is refined, step 108, by minimizing the difference, calculated in step 106, between the human-derived likeness values and the model... ...techniques known in the art.

4 2 Creating the likeness model
The objective of the model is to predict these perceived differences using the extracted **parameters** of music. To build the model, a list of numbers is calculated for the comparison of each song to each other song. The list of numbers consists of a value for each **parameter** where the value is the difference

between the **parameter** value for a first song and the value of the same **parameter** for a second song. When the model is used to compare one song to another for likeness, the list of **parameter** differences between the two songs is calculated and these differences are the inputs to the model. The model then yields a number that predicts the... ...127
P4= 015
P5 = 223
P6 = 122
1 5 P7 = 074
Another method for deriving likeness is to calculate the correlation coefficients (r) of the **parameter** values between each pair of songs in the database, and to create a matrix of similarity for the songs, with high correlation equating to high similarity. The **parameter** values are normalized to ensure that they all have the same range. Song 1 provides the **parameters** for the x values, and song 2 provides the **parameters** for the y values in the following formula.

r = EN - Xmean) (Yi - Ymean) / Ay, (xi - Xmean)2][E (yi
Ymean)2]1
Where xmean and Ymean are the means of the normalized **parameter** values for songs 1 and 2.

The rationale behind using correlation coefficients is that if the **parameters** of two songs have a high positive correlation which is statistically significant then the two songs will be judged to be alike.

Yet another method... ...deriving likeness is to use a neural net to develop the model of likeness 105. In this method, a portion of the human data and **parameter** data are used to train a network and another portion of the data are used to test the network. One such embodiment, using the neural net toolbox in Matlab TMJS described below in steps 1 to 7.

STEP 1) Construct a **vector** of **parameter** differences and correlations.

Call this IoaMat
STEP 2) Normalize the first 69 entries (the difference entries) using the mean
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(NormlMeans) and standard deviation (NormlStds) in NormlStats.mat
NormlloaMat = (loaMat(1:69)-NormlMeans)./NormlStds;
STEP 3) Divide **parameters** into classes. The indices corresponding to the
classes of different **parameter** classes for the **vector** in step 2 are defined by the following.

Class(l) = [1:14 72:92]; % **Parameter** 1
Class(2) = [18:19 70]; % **Parameter** 2
Class(3) = [71]; % **Parameter** 3
Class{4) = [19:26]; % **Parameter** 4
Class(5) = [67:69]; % **Parameter** 5
STEP 4) Apply Normalization and results from Principle Components Analysis (PCA).

a) Normalize each **vector** created in step 3 using the mean (Norm2Means)
and standard deviations (Norm2Stds) in NormMats.mat. Norm2Means and
Norm2Stds are U5 cell arrays, where each cell corresponds to each of the 5 **parameter** Classes. Thus,

normalize each **parameter** class by its respective mean and std **vectors**.

for i=1:5
Norm2loaMatClass(i) = (NormlloaMat(Class(i)
Norm2Means{i))./Norm2Stds(i);
end
b) To apply the PCA, multiply each of the **parameter** Class **vectors** created in step 4a by the corresponding matrix in the PCAMats (1x5) cell array. (i.e.,
NewClassl = PCAMats{l)*OldClassl)
for i=1:5
PCAloaMatClass(i) = PCAMats(i)*Norm2loaMatClass(i);
end
c) Concatenate Classes into a single **vector**
NetinputVect
for i=1:5
NetlnputVect [NetinputVect; PCAloaMatClass{i)];
end
STEP 5) Take the log of some of the **parameters**. A number of the transformed **parameters** in NetinputVect were found to be distributed asymmetrically (i.e. Skewed), so take the log. After taking the log, normalize according to Norm2lVleans and Norm3Stds... ...in ClassPoints.mat. To get the class of a particular song pair, simply compute the euclidian distance between NetlnputVect and each of the 2 74xl **vectors** in ClassPoints and choose the class associated with the smallest distance.

Distl = dist(NetinputVectClassPoints(:,l));
Dist2 = dist(NetlnputVectClassPoints(:,2));
if Distl<DIST2
Class=l;
else... ...of the two distance classes. To implement the network, do the following
SimNetworkWeights.mat contains the two network objects: netl net2 as well as the **parameters** of the output transformNLParameters
load SimNetworkWeights.mat
Choose the Network
if Class==l
net = net1l;
else
net = net2;
end
Compute Input Layer Activations
for i... ...exp(-(p(l)*Distance Ap(6) + p(2))));
FinalDistance = p(3)*temp.Ap(5) + p(4);
A fourth method of deriving likeness it to use **genre**- **specific** filtering. In this method, it is acknowledged that people may judge two songs as being more or less similar depending on whether or not the songs belong to the same **genre**. For example, two songs may have very similar **parameters**, but

one may have subtle differences in instrumentation or **style** that puts it into the **genre** "country" whereas the other is in the **genre** " **rock**." Because the **parameters** of the songs differ only slightly, a general purpose model may judge them to be similar. However the perceived similarity is low.

To account for this, the songs are identified as belonging to one or more **genres** and a **genre** compatibility matrix is used to determine which **genres** can be presented as matches to other **genres**. The **genre** compatibility matrix is derived by asking people to rate the compatibility of pairs of **genres**, or by a Song Domain Expert. The songs are placed into **genres** using a combination of the **genre** information imposed by the song vendor, and by the clustering techniques described below.

A fifth method of deriving likeness acknowledges the context-dependence of likeness comparisons by creating **genre-specific** models of likeness. For example, if a person listens to a Jazz song, a Punk song, a **Classical** song, and a Death **Metal** song, the Punk song and the Death **Metal** song may be judged to sound alike.

However the same two songs may be judged as being dissimilar if the Punk song is
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presented only with other Death **Metal** songs. The steps for creating a **genre-specific** model are the same as for creating a general purpose model, except that the pairs of songs, 101 given to human listeners, 102, are from the same **genre**. The songs are placed into **genres** using a combination of the **genre** information imposed by the song vendor, and by the clustering techniques described below.

4 3 Building the likeness data
The preferred method of storing and organizing the **parameter** differences data is as a multi dimensional **vector** in a multi dimensional database 107. The resulting matrix contains n*(n-l)/2 cells where n is the number of songs. The model is used by starting with a target song 109, calculating the difference in value for each **parameter** between the comparison song and the songs in the database, steps 103 - 105, and then applying the model to the difference values to arrive at...a less accurate model.

(3) How well the subset represents the set. The ability to create a model depends on the existence of patterns of **parameters** in similar songs. If the subset on which the model is based does not represent the patterns that are present in the set, then the... ...using the model to predict what sounds alike by.

(a) Only applying the technique to music which has low intra-song variability (e.g. some **Classical** music has high variability within songs).

(b) Using statistical sampling techniques known in the art (for example, for political polling) to ensure that the subset... ...2 illustrates an alternative method for finding music that sounds to human listeners like any musical composition selected by a user. Instead of using the **parameters** directly, they are processed as described in US patent application number 09/556,086 by the same inventors to create a set of descriptors 206. These are used to create a model of likeness 207 by a process similar to that used to create the model of likeness using **parameters** 105.

4 1 Collecting human data
One or more humans listen to pairs of songs and judge their similarity on a scale, for example from...P4 = 6.3

P5 = 1 5.94
4 3 Organizing and storing the likeness data
The preferred and alternative methods of organizing and storing the **parameter** differences data for calculating likeness are also used when the process uses descriptors. In addition, there is yet another alternative for calculating likeness. It involves... ...n is the number of descriptors. In this case, 59049 classes. The songs in each class have the identical descriptor values.

This provides an alternative **type** of likeness.

Computing the database
The number of combinations of songs increases with the square of the number of songs.

For large numbers of songs this creates computational challenges because of.

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(a) The amount of data that must be read from the database of **parameters** 104,
(b) The number of comparisons that have to be performed, step 105, and
(c) The amount of data that must be written to the database of **parameter** differences, 107.

Methods for dealing with these challenges are described below.

4 1 Precornputing Partitions in the Database to Decrease the Number of
Comparisons (Figure...the set of all objects fits into exactly one cluster, and any one cluster contains one or more objects.

A PISA, or Partition Intrinsic Subjective **Attribute** is a measure of how well a song fits into a category of songs. The steps for creating a PISA are as follows.

Step 1... ...following criteria.

Partitions are distinct from one another -- i.e. sufficiently far from one another in similarity space for the SDE to recognize them as **genres**.

4' All songs within the partition sound mostly alike. (by "mostly" we mean with less than a 5% false positive error rate).

Partitions are generalizable...sampling process to select 256 songs.

Step 2: Use a self organizing neural net to arrange the songs into clusters on the basis of their **parameter** values.

Step 3: The clustering results are reviewed by a song domain expert (SDE) who defines legitimate clusters by listening to the songs.

Step 4... ...improves performance.

The preferred method for decreasing the amount of data read from the database is to decrease the amount of information contained within the **parameters** by decreasing the precision of the numeric values.

Another method loads all of the **parameter** data and the likeness models into RAM and then calculates and stores all of the likeness values without further recourse to the database. Selected likeness... ...which is based on the methods using descriptors shown in Figure 2. A large set of music 401, representing "all music" is sent to the **parameter** extractor 402. The descriptors are derived and then combined with other meta data and pointers to the location of the music, for ...405, and receive the results of that interrogation using an interface 406.

An example of an interface is illustrated in Figure 5. A user can **type** in textual queries using the text box 504. For example; "Song title: Samba pa ti, Artist.

Santana." The user then submits the query by pressing... ...The song "Samba pa ti" becomes the target song, and appears in the target box 501. The computer searches the n dimensional database 405 of **vectors** made up of the song descriptors, looking for the smallest **vector** distances between the target song and other songs. These songs are arranged in a hit list box 502, arranged in increasing **vector** distance (decreasing similarity). An indication of the **vector** distance between each hit song and the target song is shown beside each hit song, expressed as a percent, with 100% being the same song. For example, the
top of the list may be "Girl from lpanema by Stan Getz, 85%."
Another **type** of query allows a user to arrange the songs by profile. First, the user presses the sort by number button 509 which lists all of... ...target box 501 and lists songs in the hit box 503 that have the closest values to the values of the target song.

Yet another **type** of query allows the user to sort by similarity plus profile. First a target song is chosen and the songs in the hit box 502...Filtering Likeness to Improve Performance
The perceived performance of the database can be enhanced by filtering the results of likeness searches.

The preferred method uses **genres** and allows a user to instruct the system to return search results from the same, or different **genres** than the target song. The **genres** are derived from a combination of the clustering methods described earlier, or from information imposed by vendors.

A second method uses meta data for individual... ...to construct song "parents." A song parent is a grouping of songs with some common elements. For example, the songs of an artist, album or **genre** may have some common elements and are parents of individual
1 6
songs. The preferred method of constructing parents is to use a grouping algorithm... ...volume, listening activity, and search activity.

A fourth method uses user preference to create a taste template. A taste template describes the ranges of the **parameter** values for a set of songs that a user likes. The taste template can be used to filter the output of the likeness model to... ...tastes. The taste templates can also be compared across multiple users using collaborative filtering. The result of collaborative filtering uncovers taste preferences between people and **parameters**. For example, people who like songs with meta data or descriptors x, y,

z also like songs with meta data or descriptors u,v,w...have good likeness matches. More explicitly, Neighborhood density is a weighted measure of how many songs appear as matches to a target song within a **specified** likeness distance. An example of the use of neighborhood density is when a user searches the database for songs in the **genre** L 9soundtrack" with the **mood** "**aggressive** ." The songs that are returned can be chosen by a number of criteria, including alphabetical order of title, most recently recorded, and neighborhood density. The... ...songs within a database that are like a target song. In the most generic implementation, a user can load a database of songs, compute the **parameters** for the songs, input a target song, compute the **parameters** for the target, and compute the likeness between the target and each song in the database using the system's model of likeness based on human perception of similarity. However, for a database of any substantial size, the computation of **parameters** for the target song and computation of likeness to other songs in the database requires so much time and processor dedication as to be impractical for large scale implementation.

1 7
Part of the solution to this efficiency problem, as described above, is to precompute the **parameters** for each song in the database. Another part of the solution, as described above, is to precompute leader songs or partitions between songs in the database. With these precomputations, if the user provides a target song, the only computation remaining is to compute **parameters** for the target and compute comparisons to the partitions in the database. However, additional speed enhancements are required to make the system practical.

The final... ...allow the user to 1 0 input a recording of a song that is not already in the database. This means that the computation of **parameters** for the target song has already been done and the computation of comparisons to other songs or partitions in the database has already been done...

Claims:

...using said precomputed set of likeness measures.

2 The method of claim 1 where the set of precomputed measures of likeness are generated by extracting **parameters** from each musical recording and computing comparisons between **parameters** for pairs of musical recordings.

3 The method of claim 1 where the method used to compute likeness measures between musical recordings was empirically developed ... ...readable data containing a computer program which causes one or more computers to perform the method of claim 4.

9 A method for using precomputed **parameters** for musical recordings to allow users to find similar musical recordings, comprising:a) for each of a plurality of musical recordings, computing a plurality of1 9 **parameters** extracted from the contents of each musical recording;b) receiving from a user a **specification** of a target musical recording for which **parameters** were precomputed and a **specification** of a set of other musicalrecordings for which **parameters** were precomputed; andC) using said precomputed **parameters**, computing likeness measures between said **specified** target musical recording and said **specified** set of other musicalrecordings; andd) presenting to the user a **specification** of one or more musical recordings from the **specified** set of other musical recordings having relatively

high computed likeness measures to the **specified** target recording.The method of claim 9 where the method used to compute likeness measuresbetween musical recordings was empirically developed based on perceptions reported...human perception of likenessbetween musical recordings, comprising:a) extracting from each of at least 5 electronic representations of musicalrecordings at least two numeric **parameters**;b) receiving from one or more human listeners who compare pairs of the musicalrecordings an indication of the human's perception of likeness for eachcompared pair of recordings;C) for each compared pair of the recordings, comparing each numeric **parameter** of one recording in the pair with the corresponding **parameter** of the secondrecording in the pair using an algorithm which produces a **parameter**comparison number;20d) for each compared pair of the recordings, combining the **parameter** comparison numbers with a weighting for each **parameter** comparisonnumber to compute a single difference number representing the differencebetween the two recordings of the pair;e) adjusting the weightings for the comparison... ...reported for the pair ofrecordings by the one or more human listeners.
16 The method of claim 15 where the algorithm includes subtraction of **parameter** values.

17 The method of claim 15 where the algorithm includes computing a correlation between **parameter** values.

18 The method of claim 15 where the algorithm employs a neural network.

19 The method of claim 15 where, prior to the step of comparing the numeric **parameters**:a) the **parameters** for each recording are combined with a weighting for each**parameter** to compute a single number representing a descriptor for thatrecording, whereb) the weightings were previously determined by adjusting the weightings to find a... ...perceptions reported for the recording by one or more humanlisteners, andC) the descriptors are then used in the step of comparing the numeric**parameters** in place of the **parameters**.
20 Computer readable data containing a computer program which causes one or more computers to perform the method of claim 15.

21 Computer readable data each musical recording of the set of musical recordings and the additional musical recordings at least two numeric **parameters**;C) associating an identifier with each recording of the set of musical recordingsand the additional musical recordings;d) assembling the identifiers for the set of musical recordings into a database; e) computing from the extracted **parameters** for each of a plurality of pairs of the recordings associated with each identifier in the database a number whichrepresents the difference between the... ...The method of claim 25 where computation of the number representing the difference between the recordings of the pair is done based on distribution of **parameter** values.
28 The method of claim 25 further comprising, within each partition, selecting one or more representative musical recordings to represent the partition and placing identifiers for additional musical recordings into partitions by comparing **parameters** for the recording associated with the identifier to **parameters** for the one or more representative musical recordings.

29 The method of claim 28 where the comparison step includes subtraction of 22**parameter** values.
30 The method of claim 28 where the comparison step includes computing a correlation between **parameter** values.

31 Computer readable data containing a computer program which causes one or more computers to perform the method of claim 25.

32 Computer readable... ...data record is associated, where each descriptor
was generated by:1 extracting from an electronic representation of the recording ofmusical at least two numeric **parameters**;2) combining the numeric **parameters** with a weighting for each**parameter** to ...weightings were previously determined by:3) extracting from an electronic representation of each of at least 5musical recordings the same at least two numeric **parameters**;4) for each recording, combining the numeric **parameters** with aweighting for each **parameter** to compute a single number23representing the descriptor for that recording;5) adjusting the weightings for the **parameters** to find a set of weightingswhere each computed descriptor for each recording most closelymatches perceptions reported for the recording by one or more... ...with descriptors that are similar to the descriptors of the comparison record.
38 The method of claim 37 further including, prior to searching the database, **specifying** that one of the descriptors of the comparison data record should be adjusted with an increase or a decrease, and the searching step is based on the descriptors of the comparison data record as adjusted.

39 The method of claim 37 where the weightings for the **parameters** are adjusted using a neural network.

40 Computer readable data containing a computer program which causes one or more computers to perform the method of...

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MUSIC DATABASE SEARCHING
RECHERCHE DANS UNE BASE DE DONNEES DE FICHIERS MUSICAUX

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Detailed Description:

...sequences or phrases in a database of recorded or encoded sound files in a computer system.

The invention relates to searching of databases of varying **types**. The database could be restricted in size, scope and file fori-nat such as a publisher's compact disc catalogue. Alternatively, the database search might be extensive in size and scope, may be widely distributed on a network, and may incorporate many different file **types**. One example would be an internet search.

In many circumstances, it is desirable to be able to search a music database for a **specific** piece of music, based solely upon knowledge of a portion of a tune or 5 musical sequence from a piece of music. Otherwise, more **detailed** conventional bibliographical infon-nation such as the title of the work, composer, publisher, lyrics etc. must be provided to effect a search, and such **details** might not always be known to the searcher.

Known problems associated with searching for a piece of music in a database of music files, based... ...is difficult because the precise location of the recognisable tune within the complexities of recorded or encoded sound is not known. A variety of file **types** such as MIDI files, MP3 files, WAV files, sequencer files, scorewriter files or files in other suitable formats must be accommodated.

Throughout the present **specification**, the expression "music file" will be used to encompass all forins of electronically, magnetically or optically stored computerreadable files which contain a digital representation of... ...sound such as in an MP3 file format, or to coded instructions for creating sound such as a MIDI file fori-nat.

Throughout the present **specification**, the expression "tune" will be used to indicate a sequence of note pitches, preferably single notes rather than chords, which can forin the basis of search criteria. Throughout the present **specification**, the expression "melody" will generally be used to refer to sequences of note pitches in portions of a music file to be searched which are... ...will be found, ea. vocal lines, or solo instrumental lines.

1 5
In the prior art, it has been suggested that search criteria can be **specified** by a relatively simple method of providing a sequence of musical contours. These musical contours describe relative pitch transitions and ...a downward
transition, "U" indicates an upward transition and "R" indicates a repetition of the previous note pitch. Such techniques have found some success with **specially** prepared databases but are limited by their inaccuracy and input of search criteria is still somewhat awkward for the unskilled user. In addition, such techniques... ...a method and apparatus for I 0 structuring music files in a computer system database in order to enable rapid or efficient searching thereof for **specified** search criteria comprising a tune.

According to one aspect, the present invention provides an apparatus for effecting a search through a database of music files...databases 9.

With reference also to figure 2, the search procedure of one embodiment of the invention will now be described in connection with further **details** of the computer I 0 system I of figure 1.

Pitch recognition
A first step 20 is to input search criteria relating to the tune... ...pitch, and preferably also the duration, of successive notes in the tune.

Preferably, the pitch recognition step 22 uses an explicit harmonic model with a **parameter** estimation stage and, if the input tune is suncr or hummed, Bayesian determination of some voice **characteristics**. Short discontinuities caused by breaks and harmonic artefacts may be filtered out. This produces a continuous, or fairly continuous, frequency-time graph 35, as shown in figure 3a and which will be described in greater **detail** later. A note discretization stage is desirable in order to eliminate problems of tuning and/or slurring, as will also be described hereinafter.

In an a mouse can be used to **type** in note names (eg. C, E, F etc). A tune may also be selected by a user from a portion of an existing stored music... ...23) is to determine a sequence of melodic intervals from the note pitches. A query definition procedure 12 uses a melodic interval generator 13 to **specify** the sequence of melodic intervals used in the query.

A melodic interval is defined as the pitch interval between a note and a preceding note... ...present invention include any of the following.

Quantization to half-steps (semitones) is preferably used if the database is reliable and the search tune is **specified** by a trained musician using MIDI keyboard or other reliable input device.

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Quantization to whole-steps (tones) or minor or major thirds if the... ...reliable, e.g. sung or hummed by an untrained user.

Quantizing to a scale, e.g. diatonic, can be used, if this can be reliably **specified** in, or deduced from, the music files and/or search tune.

Note discretization
Input tunes will typically have some notes slurred together, indicated by a...amplitude and replaced by a short continuous note with a slur on either side. Adjacent linesegments which join and which are of the same gradient-**type** are coalesced (step 44) into single straight line-segments resulting in the discretized frequency time graph 38 shown in figure 3c. Near-honizontal line-segments...be identified by generating a histogram of the input tune's frequencies and comparing it with histograms of standard scales or histograms of a large **sample** of tunes in standard scales. The comparison may be perfon-ned using, for example, a normalized least-squares comparison.

Determination of rhythmic intervals
In a... ...the first two ranges almost at random.

Other search criteria

In a preferred embodiment, as shown in step 25, further search criteria can also be **specified**, in addition to melodic intervals and rhythmic intervals, to further refine a search. For example, the query definition procedure may facilitate input of any or... ...lyrics; (b) title and composer; (c) artist; (d) filename; (e) date of composition
10
the user may well know this approximately (e.g. decade for **pop/rock** songs, century for **classical** music) without knowing the title or composer.

Comparison procedure
Once all of the search criteria have been **specified** in the query definition procedure 12 (step 26), a comparison procedure 15 is initiated.

Relevant **features** in the search criteria are compared with relevant **features** in ...low score (unless near-matches are scored higher than poor matches).

The ideal segment length and segmenting algorithm can be derived statistically from a representative **sample** of **music** files and **search** tunes.

According to preferred embodiment, segmentation algorithms may include any of the following techniques.

0
1 . Segmentation into variable-length segments based on local context...tune and music file back in step.

It is noted that the ideal segment length and the best segmenting algorithm may vary according to the **type** of music being searched. Thus in another embodiment, the query **specifies** the segmenting algorithm to be used. This may be done directly by the user, or, more preferably, indirectly by the user indicating the **type** of music being searched for, eg. **rock**, jazz, country, **classical**, etc.

I 0 In step 28, the comparison procedure systematically retrieves files from the databases 9, 10 and preferably performs the comparison operation (step 29... ...likely the search tune is the start of a melody in the search file, rather than the middle or end.

1 3
Scores for separate **features** of a music file may be combined by adding or otherwise.

Multi-pass comparisons
To increase the speed of searching large databases, there may be one or more coarse comparisons in which some reliable **features** are compared in order to exclude most of the music files, followed by a more **detailed** comparison of all **features** in order to produce a reliable score for each file not already excluded.

I 0 Musicfile pre-processing
In order to facilitate searching of varying music file **types** some pre-processing of the music files being searched may be necessary, or may simply be preferable to speed up the matching procedure.

1 5... ...of streams can be achieved in various ways. If the audio file is in stereo, then it is likely (particularly in the case of a **rock/ pop** song) that the melody voice or instrument is centred between the two audio channels, whereas accompanying instruments are offset to the left or right to...one track/channel/staff'stream has lyrics, it is very likely to be the melody
15
b) The melody is usually on track I in **type** 1 MIDI files, or the top staff in scorewriter files
C) In MIDI files, the melody is often on channel 1, or if this is... ...g.

it is extremely unlikely to consist of rests punctuated by an occasional isolated note)
1 6
P) The melody is probably at least as **loud** as all other ...above criteria would be highly reliable even though the individual criteria are not.

The most effective selection criteria to use may vary according to the **type** of music being analysed. Therefore, the selection criteria may be selected by the user according to the **type** of music known to be in the file or database being searched, as discussed in relation to the segmentation process. The selection criteria to apply might be determined automatically, particularly if a **classification** of music **type** is available in or associated with the file records.

If no one portion of the file scores significantly higher than others according to these criteria... ...also be stored, and used when scoring matches against the search tune.

Scoring criteria could include a weighting factor giving an indication as to how **popular** the matched melody is. For example, if the melody is a recent **pop** song, it
1 7
would be afforded a higher probability of a true match than a piece by an obscure composer. Popularity could be automatically...tagging, of the files is particularly important in very large databases in order to speed up searching of the database.

The indexing process discards irrelevant **features** (ie. parts which are clearly not melodies) from the music files and thereby reduces the amount of material to be searched. The index entry for... ...accompaniment or introduction.

1 5 The second stage is to segment the melodies into short groups of notes.

The third stage is to extract relevant **features** from the melodies, such as melodic intervals. **Features** other than the melodies can also be indexed to aid matching.

For example, these additional **features** may include: a) lyrics (e.cr. in a MIDI file),
C
especially the lyrics at the start of the possible tunes; (b) title and composer music files form the database which is searched.

Alternatively, tagging files may comprise marking relevant **features** within an existing file, such as

tagging the start of the melodies in a MIDI file. Tagging may
19
also include **specifying** the time signature and bar line positions to assist segmentation during the comparison procedure.

Index files can be in any suitable format. However, if an... ...is to be scored more highly than incorrect order, this can be represented by a text phrase search (which requires words to be in the **specified** order) or a 'nearness' search. Lyrics, title, artist etc. can be included as ordinary text.

Comparison procedures
A number of other strategies for improving the...a mouse. The computer plays the search tune back before searching, to confirm that it has been input as intended. The user also I 0 **types** in a few words of lyrics from the tune, then clicks a 'Search' button. The computer performs a coarse comparison between the search criteria and...is reached or if one or more higher-priority files are found to match so well that it is deemed unnecessary to search further. Further **details** of first pass search strategies will now be given.

1 5 Because a first-pass search typically searches the entire database, it is preferable to... ...examined as a series of overlapping or non-overlapping segments (as discussed earlier under "Segmentation "), and the relative frequency of occurrence of the different segment **types** is examined. For example, consider a melody note sequence of 100 notes, in the discretized, quantized output of the
23
melodic interval generator 13. If 95 segments, many will actually be reoccurrences of the same note sequences, ie re-occurrences of a segment **type**.

Supposing that there are 30 different segment **types** (ic. 30 different combinations of 5-note melodic intervals), each occurrence of each segment **type** is logged so as to derive a histogram of frequency of each possible segment **type** in the search tune and in the candidate tune. Two histograms 51, 52 are produced as shown in figure 5a and figure 5b. The segments of the search tune and candidate tune are shown in 0 these histograms. Each **type** of segment is represented by a vertical bar; the number of occurrences of that segment **type** within the tune is represented by the height of the bar. The two histograms have fairly similar contours, indicating similar relative frequencies of the various **types** of segment. The similarity of the histograms can be determined numerically by multiplying the heights of corresponding bars together 5 and summing these products to produce a similarity measure. This is the dot product of the **vectors** representing each histogram if each segment **type** represents a dimension of the **vector** and the bar-height represents the value in that dimension.

In other words, each possible segment **type** (eg. note sequence) is treated as a dimension, and each input tune is assigned a **vector** for which the value in each dimension is the number of times the corresponding segment **type** occurs in that tune. The **vector** is then normalized such that the sum of the squares of the values in each dimension is 1. A measure (between 0 and 1) of the similarity of two tunes is then given by the dot product of their **vectors**. Segment **types** which occur unusually frequently in a candidate file may be more likely to be accompaniment motifs rather than part of the tune, so it may... ...histogram of the pitchclasses they contain and comparing this (using, for example, a normalized leastsquares comparison) with histograms of standard diatonic scales or with relevant **sample** music data. Because the key may be ambiguous or may possibly vary

within a file, a measure of the probability that the music is in...s segments, it may be possible to exclude a further 50% of the remainder for being in the wrong mode, leaving just 25% for more **detailed** searching in subsequent passes.

Reliable criteria, such as whether or not the candidate files contain any of the input tune's segments, are suitable for...or extra notes. The value of n is initially set to ni - which could typically be equal to i - and an "increasing- n" loop control **parameter** set to true (step 702). n may be given fixed upper and lower limits, typically related to the number of notes in the input tune...to an F to produce the latter. If the input tune is a poorly-sung or mis-remembered version of the candidate tune, these three **types** of change may represent extra notes, missing notes and wrong notes.

29
The degree of match is scored using a measure based on these changes... ...caused by poor tuning in the input tune rather than completely wrong notes.

I 0 The present invention has been described with reference to - certain **specific** embodiments as depicted in the drawings which are not intended to be in any way limiting. Variations to the embodiments described are within the scope...

Claims:

...with a plurality of 1 5 segments from said plurality of computer-readable music files, means for determining a number of matches of each segment-**type**, and wherein said output means bases the likelihood of a match based on a comparison of the profile of the nurtiber of each segment-**type** for said tune and for said music files.

29 Apparatus according to claim I I in which the means for measuring a degree of matching...

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A SEMICONDUCTOR MEMORY CARD, PLAYBACK APPARATUS, RECORDING APPARATUS, PLAYBACK METHOD, RECORDING METHOD, AND COMPUTER-READABLE RECORDING MEDIUM
CARTE MEMOIRE A SEMI-CONDUCTEURS, APPAREILS DE REPRODUCTION SONORE ET D'ENREGISTREMENT, PROCEDES DE REPRODUCTION SONORE ET D'ENREGISTREMENT, ET SUPPORT D'ENREGISTREMENT LISIBLE PAR ORDINATEUR

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Claims:

...achieving a suf f iciently high compression ratio f or digital
music is MPEG2-AAC (Motion Pictures Experts Group 2 3Advanced Audio Coding) One
characteristic of MPEG2-AACcompression is that it makes use of the limitations of humanhearing and

so changes the bit length of the data assigned... ...MPEG2-AAC depends on the number of audible frequenciesin the frame (or in other words, because MPEG2-AAC usesvariable-bitrate (VBR) encoding), high-**quality** audiocontents can be obtained even at high rates of compression,Such audio contents are suited to distribution on a publicnetwork and to storage...will regardsemiconductor memory card players as inferior to MDrecorders, thereby damaging the commercial potential ofsemiconductor memory card products.Third ProblemTo provide **special** playback functions for digitalmusic that has been subjected to VBR encoding, as underMPEG2-AAC, playback apparatuses need to be equipped withlarge-capacity memories. This raises the manufacturingcost of such apparatuses, and poses a third problem forthe background art,The **special** playback functions provided by MD or CDplayers include the ability to start playback f rom any trackon a disc (**specif** ying the playback position) , a **music** **search**function that plays back intermittent bursts of music toenable users to skip through tracks forwards or backwards25 at high speed, and a time... ...6a time measured from the start of the disc. To capturethemarketcurrentlyheldbyMDorCDplayers, itisessentialfor playback apparatuses of semiconductor memory cards toprovide the same **special** playback functions as MD players,When music contents are subjected to constant bitrate (CBR)encoding, playback from a position **specified** using a timecode (such a point one or two minutes from the start ofa track) can be perf ormed simply by ref erring... ...cannot be said for the time search tables of long tracks,,so that the time search tables of long tracks are very large,To provide **special** playback f eatures, a playback apparatushas to access the time search table having first loadeditintoitsmemory. Sincelongtrackshavelargetimesearch25 tables,, this means that a playback... ...while allowing users toedit the music contents.It is a second object of the present invention toprovide a playback apparatus that can perform **special**playback functions such as forward and backward **search** for**music** contents recorded on a semiconductor memory cardwithout using a large-capacity memory.The first object of the present invention can be achievedby a... ...present semiconductor memory cardminimizes the damage caused by the exposure of one of theencryption keys.Here, each audio track may further include (1)**attribute** inf ormation and (2) link inf ormation f or eachaudio object included in the audio track, the **attribute**information showing a **type**, out of **type** (a),, **type** (b) , **type**(c) and **type** (d), for each audio object, **type** (a) beingan entire audio track, **type** (b) being a f irst part of anaudio track, **type** (c) being a middle part of an audio track,and **type** (d) being an end part of an audio track, and thelink information for each audio object that is **type** (b)or **type** (c) showing which audio object follows the audioobject.Use of the stated construction achieves the effectsdescribed below. The **attribute** information shows how theencrypted audio objects compose audio tracks, so that whentwo audio objects are managed as two separate audio tracks,9such tracks can be combined to f orm a single track by merelychanging the **attribute** information to show that the audioobjects correspond to the start and end of a track. Sinceaudio tracks can be combined by changing the **attribute**information. tracks can be combined at high speed withoutneeding to remove the encryption of the audio tracks.Here, the plurality of audio objects may... ...in the management inf ormation; and lengthinformation showing a length of the valid data that startsfrom a position indicated by the offset, the **attribute**information for an audio object showing whether the validdata indicated by the offset and the length information(a) corresponds to an entire audio track... ...management information forthe audio object currently being played back into itsinternal memory, This enables playback apparatuses with12limited memory capacity to perform **special** playbackfunctions such as forward and backward search.The assignment of the plurality of audio objects toaudio tracks and the order to be used... ...information,so that tracks can be freely edited by merely updating themanagement information.Brief Description Of The DrawingsThese and other objects, advantages and **features** ofthe invention will become apparent from the followingdescription thereof taken in conjunction with theaccompanying drawings which illustrate a **specific**embodiment of the invention. In the Drawings:FIG, 1 shows the appearance of a flash memory

card31 when viewed from above;FIG. 2 shows... ...31 when viewed from below;FIG, 3 shows the hierarchical composition of the f lashmemory card 31 in the embodiments;FIG, 4A shows the **special** region, the authenticationregion and the user region provided in the physical layerof the flash memory card 31;FIG, 4B shows the composition of the authenticationregion and the user region in the file system layer;FIG. 5 shows the **detailed** composition of the file13system layer;FIG. 6 is a representation of when the AOB file"AOB001.SAI" is divided into five parts that are providedin the user region and the authentication region in thefile system layer when the above two **types** of data arerecorded in the application layer, as well as what kindof files are recorded in which directories;FIG, 9 shows the correspondence... ...the AOB files in the SD-Audio directories;FIG. 10 shows the hierarchical composition of thedata in an AOB file;FIG. 11A shows the **parameters** stipulated by ISO/IEC13818-7 standard in tabular form;FIG, 11B shows the **parameters** that should be usedwhen encoding a f ile in MPEG-Layer 3 (MP3) f ormat in tabularform;FIG. 11C shows the **parameters** that should be usedwhen encoding a f ile in Windows Media Audio (WMA) f ormatin tabular form;FIG, 12 shows the **detailed** construction of anAOB-FRAME;14FIG, 13 shows how the byte length of the audio datain each of three AOB-FRAMEs is set;FIG. 14 shows the correspondence between thesamplingfrequency and the number of AOB-FRAMEs includedin an AOB-ELEMENT;FIG. 15 shows **examples** of the **playback** periods ofAOB-ELEMENTs and the playback periods of AOB-FRAMEs;FIG. 16 shows what is reproduced when the AOBs andAOB-BLOCKs recorded in an AOB f ile are consecutively playedback;FIG, 17 shows the hierarchical composition of thePlaylistManager and TrackManager used in the embodimentsin **detail**;FIG. 18 shows the sizes of the PlaylistManager andthe TrackManager;FIG. 19 shows the correspondence between the TKIsshown in FIG. 17 and the AOBs and AOB f iles shown in FIG.16;FIG. 20 shows the **detailed** data composition of theTKTMSRT shown in FIG. 17;FIG. 21 shows one example of the TKTMSRT;FIG, 22 shows the **detailed** composition of the TKGI;FIGs. 23A and 23B show the **detailed** composition ofthe BIT, and FIG. 23C shows the Time-Length field;FIG. 24 shows cluster 007 to HE into which the AOBcomposed of... ...AOB;FIGs. 26A and 26B shows how an AOB,, an AOB-ELEMENT,,and an AOB-FRAME that correspond to an arbitrary playbacktime code are **specified**;FIGS. 27A and 27B show the deletion of a track;FIG. 28A shows the TrackManager after the deletionof a track has been performed several... ...the TrackManager;FIGS. 29A and 29B show the TKIs are set when two tracksare combined to produce a new track;FIG. 30A shows a **Typel** AOB;FIG. 30B shows **Type2** AOBs;FIG. 31A shows the combining of a plurality of tracksinto a single track for a combination of a **Typel**+ **Type2**+**Type2**+ **Typel** AOB;FIG. 31B shows the combining of a plurality of tracksinto a single track for a combination of a **Typel**+ **Type2**+ **Type2**+ **Type2**+ **Typel** AOB;FIG. 32A shows a pattern where a **Typel** AOB is presentat the end of a preceding track and a **Typel** AOB is presentat the start of a next track;FIG. 32B shows a pattern where a **Typel** AOB is presentat the end of a f irst track and a **Type2** AOB is present at16the start of a next track;FIG, 32C shows a pattern where a **Typel** and **Type2** AOBare present at the end of a first track and a **Typel** AOBis present at the start of a next track;FIG. 32D shows a pattern where a **Typel** and **Type2** AOBare present at the end of a first track and a **Type2** anda **Typel** AOB is present at the start of a next track;FIG. 32E shows a pattern where two **Type2** AOBs arepresent at the end of a first track and a **Typel** is presentat the start of a next track;FIGS. 33A and 33B show the division of a track toproduce two tracks;FIGS. 34A... ...AOB-ELEMENT#2;FIG. 36 shows how the BIT is set when an AOB is dividedas shown in FIG. 35;FIG. 37 shows a **specific** example of changes in theBIT before and after division;FIG. 38 shows a **specific** example of changes in theTKTMSRT before and after division;17FIG, 39A shows the format of a DPL-TK-SRP;FIG. 39B shows the the flash memory card 31 of the presentembodiments;FIG. 49 shows one **example** of the **display** on the LCDpanel when a playlist is selected;FIGS. 50A to 50E show **examples** of the **display** on theLCD panel when a track is selected;FIGS, 51A to 51C show example operations of the

jog18dial;FIG, 52 shows the... ...used;FIGS, 61A to 61D show how the playback time code isincremented when the forward search function is used;FIGS, 62A and 62B show **specific** examples of how thetime search function is used;FIG, 63 is a flowchart showing the processing in the19editing control program;FIG. 64... ...15 a playback apparatus connected to the flash memory card31 reads the encryption key FileKey and plays back AOBs;andFIG. 71 shows the **details** of the communicationsequence used when mutual authentication is performed inFIG, 70,Best Mode for Carrying Out the InventionThe following describes a semiconductor... ...the notation given below.lxl-x2-x3-x4lThe length of a reference number shows the level ofthe topic in the hierarchy. As a **specific** example, thenumber xl is the number of drawing that is being referredto in the explanation. The drawings attached to this **specif** ication have been numbered in the order in which theyare referred to in the **specification**, so that the orderof the drawings roughly matches the order of the explanation,The explanation of certain drawings has been divided intosections,, with... ...a drawing indicatedby the reference number x1. The reference number x3 showsthe number of an additional drawing that is provided toshow the **details** of the section indicated by the sectionnumber x2. Finally, the reference number x4 shows thenumber of a section in the explanation of this... ...the Physical LayerThe three regions shown in FIG, 4A are provided inthe storage area composed of these valid sectors. Theseregions are the "**special** region", the "authenticationregion" and the "user region", and are described in **detail**below, The user region is characterized in that a deviceto which the flash memory card 31 is connected can freelyread or write various kinds of data f rom or into this region. Areas within the user region are managed by a file system.The **special** region stores a media ID that is a valueuniquely assigned to each flash memory card 31. Unlikethe user region, this region is read-only,, so that the mediaID stored in the **special** region cannot be changed.The authentication region is a writeable region, likethe user region. This region dif f ers from the user regionin... ...encrypting the written data is itself encryptedto make the copyright protection more secure, Any valueobtained by subjecting the media ID stored in the **special**region into a predetermined calculation can be used toencrypt the FileKey. The encrypted FileKey produced in24this way is stored in the authentication... ...following describes the file system layer presenton this physical layer. While the file system layer ofa DVD uses a UDF (Universal Disk Format) -**type** file system,the file system layer of the flash memory card 31 uses aFAT (File Allocation Table) -**type** file system, as describedin ISO/IEC 9293,FIG, 4B shows the construction of the authenticationregion and the user region in the file system... ...25 authentication region and the user region have the sameconstruction, FIG. 525shows the various parts of these f ile systems in more **detail**,The f ollowing describes the construction of the user regionwith reference to FIGS. 4A. 4B and 5,(3-2 4B-2) Partition Boot Sectors... ...5-1) Root Directory EntriesThe "root directory entries" are inf ormation showingwhat kinds of files are present in the root directory. As27**specific** examples, the 'If ilename" of an existing file,, its'If ilename extension", the "revision time/date" and "numberof first cluster in file" showing where...8B show what kind of directories arepresent in the user region and the authentication regionin the f ile system layer when these two **types** of data arestored in the application layer, as well as showing whatfiles are arranged into these directories.The filenames "SD-AUDIO,PLM" and...transport stream into a sequence of AOB-FRAMEs and storingthese AOB-FPAMEs.13-3 10-1 111 MPEG2-AACMPEG2-AAC is described in **detail** in ISO/IEC13818-7: 1997 (E) " Information Technology - Generic Codingof Moving Pi ctures and Associated Audio Inf ormation - Part7Advanced Audio Coding (AAC)".It should be noted that audio objects can only be compressed according to MPEG2-AAC using the **parameters** inthe **parameter** table shown in FIG. 11A that is defined inISO/IEC13818-7, This **parameter** table is composed of" **Parameter**" column, a "Value" column, and a "Comment"column.The legend "profile" in the **Parameter** column showsthe only LC-prof ile can.be used, as stipulated under ISO/IEC13838 The legend "sampling-frequency#index" in the**Parameter**

column shows that the sampling f requencies "48 kHz,44.lkHz, 32kHz, 24kHz, 22.05kHZ, and 16kHz" can be used.36The legend "number-of-data-block-in-frame'I in the**Parameter** column shows that the ratio of one header to oneraw-data-block is used.Note that while this explanation describes the casewhere AOB... ...AOB-FRAMEs may instead be encoded according to anotherformat, such as MPEG-Layer3 (MP3) format or Windows MediaAudio (WMA) . When doing so, the **parameters** shown in the**parameter** tables of FIG. 11B or FIG. 11C must be used.(3-3 10-2 12) Composition of an AOB FRAMEWhile each AOB-FRAME includes... ...AOB-ELEMENT at the start or end of an AOBmay be less than a number calculated in this way.While no header or other **special** information isprovided for each AOB-ELEMENT, the data length of eachAOB-ELEMENT is instead shown by a time search table.(3-3 10... sizeof the time search table to 504 bytes or less,f3-3 10-81 Restriction of the Time Search TableThe following describes in **detail** why the size ofthe time search table is restricted by limiting the playbackperiod.When a playback apparatus performs a forward orbackward search... ...start and end position of theAOB-BLOCKs within an AOB are shown by BITs included in thenavigation data, These BITs are described in **detail** later43in this **specification**.This completes the explanation of what data is storedin anAOB f ile. The f ollowing describes what kind of contentis played back when...give a variety of inf ormation, such as the playbackperiod of AOBs and the song names and songwriters of thevarious AOBs,In this **specification**, the term "track" refers toa meaningful playback unit for users, so that whencopyrighted music is stored on a f lash memory card 31... ...5 of tracks. A plurality of Playlists can be included inthe PlaylistManager.The following describes the TrackManager withreference to the drawings.117 18) **Detailed** Compositionof the PlayllstManager and TrackManagerFIG, 17 shows the **detailed** composition of thePlaylistManager and TrackManager in this embodiment as ahierarchy. FIG. 18 shows the sizes of the PlaylistManagerand the TrackManager. The right side of FIG, 17 shows theitems on the left side in more **detail**, with the broken linesindicating which items are being shown in more **detail**.As shown in FIG. 17, the TrackManager is composedof the Track Information (TKI) #1, #2, #3, #4 . . . #n,as shown by the broken line...TA3,, TA4 . . .in FIG, 19,In this way,, each TKI corresponds to a dif f erent AOBrecorded in an AOB f ile and gives **detailed** inf ormation thatapplies only to the corresponding AOB.(17-3 20) Data Composition of a TKTMSRTThe following describes the information that appliesto single AOBs recorded in AOB files, starting with theTKTMSRT. FIG. 20 shows the data composition of the TKTMSRTin **detail**.The right side of FIG, 20 shows the **detailed** datacomposition of the time search table header (TMSRT-Header) .In FIG. 20,, the TMSRT-Header has a data size of eight bytes,and is... ...TMSRT-ID". The total number of TMSRT entries inthe present TMSRT is recorded in the "Total TMSRT-entryNumber".49(17-3 21-1) **Specific** Example of the TKTMSRTThe following describes a TKTMSRT in **detail**. FIG,21 shows one example of a TKTMSRT, The left side of FIG.21 shows anAOB, while the right side shows the correspondingTKTMSRT, The... ...By reading and storing TKIs in this way,, the necessary52capacity of the memory in the playback apparatus can beminimized while still enabling **special** playback functionssuch as forward and backward search to be realized. Whilethe present embodiment describes the case where the datalength f rom the...relative addresses from the start of theAOB-BLOCK to the first addresses of AOB-ELEMENTs may bewritten in there instead.(17 21-3) **Specifying** a ClusterInclucLing an AOB.ELEMENTThe following describes how an AOB-ELEMENT may beread using the TKTMSRT, The TKTMSRT includes the size of... ...the remainderproduced when a is divided by bThe DATA-Of f set is written in the BIT and is describedlater in this **specification** .(17-41 TKTX1 DAThis completes the explanation of the time searchtable (TKTMSRT) . The following describes theTrack-Text-Inf ormation DataArea (TKTXI-DA... ...information shown as the identifier "TKI-ID" of the TKI,theTKInumber"TKIN", theTKI size "TKI-SZ", alinkpointerto the next TKI "TKI-LNK-PTR", block **attributes**"TKI-BLK-ATR", a playback period "TKI-PB-TM11, the audio**attributes** "TKI-AOB-

ATR",, an"ISRC", andblockinformation"BIT", Note that only some of this information has been54shown in FIG, 17 to simplify the representation.117-5 22-1) TKGIThe following describes the composition of a TKGIin **detail**, with reference to FIG. 22. The differencebetween FIG. 17 and FIG. 22 is that the data compositionof the TKGI that was shown in... ...TKI#4 to TKIVandthe fourAOB files "AOB004.SAl" to "AOB007.SAl" composea single track, TrackD.(17-5 22-71 TKI BLK ATRThe **attributes** of present TKI are written in the"TKI-BLK-ATR". In FIG. 22, the information shown withinthe broken lines extending form the TKI-BLK... ...the bitsfrom b3 to b15 being reserved for future use. The threebits f rom bit b2 to bO are used to show the **attributes** ofthe TKI,When one TKI corresponds to a complete track, thevalue "00b" is written in the ...producing an AOB,which is to say information such as.(1) the samplingfrequency at which the AOB recorded in the correspondingAOB file was **sampled**, (2) the transfer bitrate, and (3)the number of channels, is written in the "TKI-AOB-ATR"in a TKI. The bit composition of the...between bit b64 and bitb69. A one-bit Validity f lag is written in a one-bit f ieldcomposed of bit b79. A **detailed** description of ISRC canbe found in IS03901:1986 "Documentation-InternationalStandard Recording Code (ISRC)II,117-5 22-12 23A-1) BITThe "Block Information Table (BIT) " is a table formanaging an AOB-BLOCK, and has the **detailed** compositionshown in FIGS, 23A and 23B.As shown in FIG. 23A,, a BIT is composed of a DATA-OFFSETfield that occupies a region... ...byte,, anda TIME-LENGTH field that occupies a region from the 78thbyte to the 79th byte.Each of these fields is described in **detail** below,(17-5 22-12 23A-2) DATA OffsetThe relative address of the start of an AOB-BLOCKfrom the boundary between clusters is...2s+240ms from theAOB-FRAME#x included in the AOB-ELEMENT#y will def initelybe present in the AOB-ELEMENT#y+l, When **specifying** theAOB-FRAME#x+l that is 2s+240ms from the AOB-FRAME#x,, thef irst address of the next AOB-ELEMENT#Y+l... ...a time search f unctionwhere playback starts at a point indicated using a timecode. In FIG, 26A, shows how a playback apparatus can **specif** y the AOB-ELEMENT and AOB-FRAME corresponding to theplayback start time indicated by the user, When playbackis to commence from a time...the reasons given above, editing operations thatcombine tracks leave the AOB f iles in their encrypted stateand are achieved by merely changing the **attributes** givenby the TKI-BLK-ATRs.117-5 22-18 29A,B-1 30, 31) Conditions That Should beSatisfied When Combining TracksThe combining of tracks is performed by changing theTKI-BLK-ATR **attributes** as described above, but the AOBsthat are included in the combined tracks should satisfythe conditions given below.A first condition is that the AOB that is to composea latter part of a new track needs to have the same audio **attributes** (audio coding mode, bitrate, sampling frequency,number of channels, etc.) as the AOB that is to composethe first part of the new track. If an AOB has differentaudio **attributes** to the preceding or succeeding AOB, theplayback apparatus will have to reset the operation of the76decoder, which makes seamless (i.e., uninterrupted... ...AOB-ELEMENTs whose number of AOB-FRAMEs is below therequired number for an "FNs-Middle-TMSRTE" cannot belinked.AOBs are classified into two **types** depending onwhether at least one AOB-ELEMENT includes a same number10 of AOB-FRAMEs as the number of frames stipulated for an"FNs-Midd1e-TMSRTE". The **Typel** AOB includes at least oneAOB-ELEMENT having this number of AOB-FRAMEs. while the **Type2** AOB includes no AOB-ELEMENT having this number ofAOB-FRAMEs.In other words,, AOB-ELEMENTs in a **Type2** AOB have f ewerAOB-FPAMEs than "FNs-Midd1e-TMSRTE",, and the secondcondition stipulates that three **Type2** AOBs cannot be linkedtogether. The reason for the second condition is as follows.20 When the playback apparatus reads AOBs successively, itis preferable for a sufficient number of AOB-FRAMEs toaccumulate in the buffer of the playback apparatus, thoughthis cannot be achieved when there are consecutive **Type2**AOBs. In such case, an underflow is likely to occur in25 the buf f er of the playback apparatus, so that uninterruptedplayback by... ...playback apparatus can no longer be77guaranteed. Theref ore, in order to

avoid such underf lows,the second condition stipulating that three or more **Type2**AOBs cannot be linked continuously is used,FIG. 30A shows a **Typel** AOB, while FIG. 30B shows twoexamples of **Type2** AOBs. In FIG, 30B,, both AOBs are composedof less than two AOB-ELEMENTs , wi th none of the AOB-ELEMENTsincluding a number of FNs-Middle-TMSRTE"is the condition by which an AOB is classified as a **Type2**AOB,, this means that all of the AOBs shown in this drawingare classified as **Type2** AOBs.In FIG. 31A,, a combining of **Typel+Type2+Type2+Typel**AOBs into a single track is shown. As this combining does15 not involve the linking of three **Type2** AOBs, these AOBsmay be linked to form a single track,FIG. 31B shows the linking of **Typel+Type2+ Type2+Type2+Typel** AOBs into a single track. This combining wouldresult in there being three consecutive **Type2** AOBs, andso is prohibited.{17 22 29A,B 321 Combiningof Trackswithrespectto combinations of **Typel** and **Type2** AOBSIn the combining of AOBs into a single track shownin FIG. 31A, if the last AOB in the first track is a **Typel**AOB, the combining can be performed regardless of whether78the first part of this track is a **Typel** AOB or a **Type2** AOBFIG, 32A shows the case where the last AOB in the firsttrack is a **Typel** AOB and the first AOB in the next trackis also a **Typel** AOB. FIG. 32B shows the case where thelast AOB in the first track is a **Typel** AOB and the firstAOB in the next track is a **Type2** AOB. As the second conditionis satisf ied in both of these cases,, the illustrated trackscan be combined into a single track.When the last AOB in the f irst track is a **Type2** AOBand the preceding AOB in the first track is a **Type** 1 AOBj,this first track can be combined with a following trackthat starts with a **Typel** AOB regardless of whether the firstAOB in the first track is a **Typel** AOB or a **Type2** AOB,FIG. 32C shows the case where the first track endswith a **Typel** AOB and a **Type2** AOB in that order and the secondtrack starts with a **Typel** AOB. FIG. 32D shows the casewhere the first track ends with a **Typel** AOB and a **Type2**AOB in that order and the second track starts with a **Type2**AOB and a **Typel** AOB in that order, As the second conditioni s satisfied in both of these cases, the illustrated trackscan be combined into a single track.When the first track ends with a **Type2** AOB and theimmediately preceding AOB is also a **Type2** AOB,, this firsttrack can be combined with a following track that startswith a **Typel** AOB. FIG. 32E shows the case where the firsttrack ends with two **Type2** AOBs and the second track starts79with a **Typel** AOB. As the second condition is satisfiedin this case, the illustrated tracks can be combined intoa single track. In this way, when two...copied fromthe original TKI and (2) information obtained by updatingthe information in the original TKI. The TKTXTI-DA andISRC are the former **type**, while the BIT, the TKTMSRT andother information fields are the latter **type**. Since both**types** of information exist, the present embodimentgenerates a TKI for a divided track by copying the originalTKI to produce a template for the new... ...that follows the boundary once AOB-ELEMENT#2 has beendivided.(17 22 33A,B 371 Setting of the BITFIG. 37 shows a more **specif** ic example of changes inthe BITs as a result of the division of a track. The leftside of FIG. 37 shows an example...Playlist-Information in the flashmemory card 31, or can have a playback apparatusautomatically generate Playlist-Information that onlyindicates tracks of a certain **genre**, out of a pluralityof tracks stored in the flash memory card 31, and storethe resulting Playlist Inf ormation in the f lash memory...number is written in the DPLTKIN that occupiesthe Oth to 9th bits in the DPL-TK-SRP. This enables a TKIto be **specified**.17-9 39B} Format of the PL TK SRPFIG. 39B shows the format of the PL-TK-SRP. This isa ten-bit field... ...is to say, the DPL-TK-ATRis set at one of "Track",, "Head-of-Track""Midpoint-of-Track", and "End-of-Track".In more **detail**, when the TKI indicated by the TKINis used and an Audio Object (AOB) corresponding to onecomplete track is recorded in the AOB file...After this,AOB#3 and AOB#l that respectively compose TrackC and TrackAare played back as shown by the arrows (33) and (34).Of **special** note here is that when a track is composedof a plurality of TKI, only the TKI number of the startof the track is written into the PL-TK-SRP entry. In more**detail**, while the DPL-TK-SRP values given in theDefault-PlaylistInformation **specifies** the four

TKIs(TKI#4,TKI#5,TKI#6,TKI#7) that compose TrackD, thePL-TKSRP given in a set of Playlist-Information... ...this way, the user can be given the impressionof there being a number of music albums stored in the flashmemory card 31.Of **special** note here is that the data size of theDPL-TK-SRP corresponding to an AOB file is small (at nomore than two bytes... akeypanelforreceivinguser indications for operations such as playback, forwardsearch, backward search,, fast forward, rewind, stop etc.,and an LCD (liquid crystal display) panel. In **terms** ofappearance, this playback apparatus resembles other kindsof portable music players.The key panel includes:a "Playlist" key that receives the selectionof a... ...thetime search f unction or as a division boundary when dividinga track.(48 49.50) Improvement (2)The following describes improvement (2) in **detail**.FIG. 49 shows one example of a display screen shown on theLCD panel when the user selects a playlist, while FIGs.50A to 50E... ...ifthe user presses the "Edit" key, the indicated track willbe selected for editing.(48 511 Improvement (4)The following describes improvement (4) in **detail**,FIGS. 51A to 51C show an example operation of the jog dial.When the user rotates the jog dial by a certain amount,108the...displayinga list of tracks or playlists and a playback time code f ramefor displaying a playback time code, an LCD driver 6 for**driving** the f irst LCD panel 5 . a descrambler 7 f or decryptingAOB-FRAMEs using a different FileKey for each AOB file,an AAC decoder... ...a CPU 10 for performingoverall control over the playback apparatus. As can be understood from this hardware construction.the present playback apparatus has no **special** hardwareelements for processing the TrackManager andDefault-Playlist-Information. To process theTrackManager and Default-PlaylistInformation, a DPLIholdJ ng area 11 , a...then to step S4 wherethe TKI#z indicated by the DPL-TKIN corresponding toDPL-TK-SRP#w in the Default-Playlist-Information is **specified** and only this TKI#z is read from the flash memorycard 31 and stored into the TKI storing area 13.In step S5 , an AOB f ile#z with the same number as TKI#zis **specif** ied. In thJ s way, the AOB f i le that is to be playedback is finally **specified**.The **specified** AOB file is in an encrypted state andneeds to be decrypted, so that steps S6 and S7 are perf ormed.In step S6,, the... ...J s stored115in a FileKeyEntry#z in the encryption key storing file,the FileKey-Entry#z having the same number as the **specified**AOB file. In step S7. the CPU 10 sets the FileKey#z inthe descrambler 7. This operation results in the FileKeybeing set in... ...this, the playback apparatus successively readsthe clusters that store the AOB file. In step S 8, the " firstcluster number in the file" is **specified** for the AOB-f ile# zin the directory entry. In step S9, the CPU 10 reads thedata stored in this cluster from the... ...step S13, where the variable#w isincremented (#w.#w+l) bef ore the processing returns to stepS4. In step S4. the playback apparatus **specifies** TKI#zwhich is indicated by the DPL-TKIN#w of DPL-TK-SRP#w inthe Default-Playlist-Information, and writes only TKI#z ...AOB-FPAME has been outputted to thedescrambler 7,, in step S26 the playback apparatus refersto the ADTS header of AOB-FPAME#x and **specifies** where thenext AOB-FRAME is. In step S27, the playback apparatusincrements the variable#x (#x+--#x+l) and sets AOB-FPAME#xasthenextAOB...of steps S22 to step S54 is repeated.This means that the TKI indicated bv the DPL TKIN of thenext DPL-TK-SRP is **specif** ied and the AOB f ile correspondingto this TKI, which is to say, the AOB file with the samenumber as the TKI, is **specified**.After this, the playback apparatus accesses theauthentication region and **specifies** the FileKey, out ofthe FileKeys in the encryption key storing file, that hasthe same number as the TKI, before reading this FileKeyand... ...Stop" or "Pause" key has alreadybeen described, though when the user presses one of thekeys provided to have the playback apparatus perf orm **special**playback, the processing in this flowchart, or in theflowcharts shown in FIGS. 56, 57, or 58 is terminated andsuitable processing for the pressed...FNs-Midd1e-TMSRTE11 in the BIT is "94 frames", and the"FNs-Last-TMSRTE" in the BIT is "50 frames".130-13 62ApB)As one **specif** ic example of when the time search f unctionis used, the following describes how the AOB-ELEMENT andframe position from which playback should start are**specified** when a playback time code is indicated using thejog dial.As shown in

FIG. 62A, the user holds the playbackapparatus in his/her... ...step S112, the CPU 110 refersto the BITs in the TKIs of the former and the latter tracksand judges what kind of AOBs (**Typel** or **Type2**) are present133at the respective start and end of each of these tracksand tracks on either side of these tracks, if present.After identifying the **type** of each relevant AOB, instep S113 the CPU 10 judges whether the arrangement of AOBsmatches a certain pattern. When the arrangement of AOBsmatches one of the four patterns shown in FIG. 32A to 32Dwhere it is clear that three **Type2** AOBs will not be presentconsecutively after the combining, the former and lattertracks are combined into a single track in step S115.In the... ...When the arrangement of AOBs doesnot match any of the patterns in FIGS. 32A to 32D, meansingthat there will be three or more **Type2** AOBs after thecombining, the CPU 10 judges that the combined track maycause a buffer underf low and so terminates the combiningprocess.(52...S134. This procedure is repeatedso that the second, third and f ourth tracks are successivelyselected. If the user presses the "Stop" key have **specified**several tracks that are to be played back in the **specified**order as a new Playlist, the processing advances from stepS134 to step S138 where a PLI composed of PLTKSRPs that**specif** y the TKIs corresponding to these tracks is generated.(66-11 Recording ApparatusThe following describes one example of a recordingapparatus for the f...playback apparatus , the main f unctioningof the recording apparatus is stored in the ROM. This isto say,, a recording program that includes the **characteristic** processing of the recording apparatus, which is to say,the recording of AOBs, the TrackManager, and thePlaylistManager, is stored in the non-removable disk...31 and does notdescribe the internal hardware construction used. Thissecond embodiment, however, describes the hardwareconstruction of the flash memory card 31 in **detail** .{69-11 Hardware Conf J guratlon of the Flash Memory Card 31FIG. 69 shows the hardware construction of the flashmemory card 31. As... ...memory card31 includes three IC chips, namely the control IC 302, theflash memory 303, and the ROM 304.The ROM 304 includes the **special** region described inthe first embodiment and is used to store the media IDmentioned in the first embodiment,, in addition to a securemedi... ...circuit composed ofactive elements (logic gates) and includes an authorizationunit 321, a command decoding unit 322, a master key storingunit 323, a **special** region access control unit 324, anauthentication region access control unit 325, anon-authentication region access control unit 326, and an149encryption/decryption... ...inputted viathe COMMAND pin. The command decoding unit 322 controlsthe components 321-327 in the control IC 302 in accordance150with the **type** of inputted command.The commands issued to the f lash memory card 31 includecommands that read, write, or delete data in the f lash... ...its encrypted form.The master key 323a is encrypted in a way that only allowsdecryption by a device that receives the master key using **specJ** al key inf ormation (generally called a "device key") .The **special** region access control unit 32 4 is a circuitthat reads the media ID stored in the ROM 304 that providesthespecialregion. ThemediaIDreadbythespecialregion151access ...eachinclude an internal buffer capable of storing one blockof data and perform input and output via the pins markedDATA1 to DATA4. In **terms** of logic, such input and outputare performed in units of sectors, but when the contentof the flash memory 303 is rewritten, data is inputted oroutputtedinblockunits (eachblockbeing32sectors (16KB)in size) . In more **detail**,, when the data in one sector isrewritten, the appropriate block is read from the flashmemory 303 and stored in the buf f er... ...apparatus will be able to successfully obtain the masterkey by performing this decryption,Af ter receiving the master key, the playback apparatusissues a **special** command to the flash memory card 31 toread the media ID (sc4) . The **special** region access controlunit 324 obtains the media ID from the ROM 304 of the flashmemory card 31 and passes it over to the... ...region of the flash memory card 31. As oneexample, when data is to be read from the authenticationregion, the playback apparatus encrypts the **parameters**(i.e., a 24-bit address "address" and an eight-bit datalength "count") of the "SecureRead address count" commandusing the secure key (sc8) , and links these **parameters** withthe tag of this command (i.e., a 6-

bit code showing thatthis command is a "SecureRead") to produce an encryptedcommand (sc9) , which the playback apparatus sends to theflash memory card 31 (sclO).On receiving this encrypted command,, the flash memorycard 31 identifies the **type** of command from the tag (scll) .In the present example. the f lash memory card 31 identif iesthat the command is a "SecureRead" command for a read fromthe authentication region.When a read command has been identified, theencryption/decryption circuit 327 decrypts the **parameters** 155included in the command using the secure key (sc12) obtainedduring the mutual authentication (sc13).The algorithm used to decrypt the **parameters**corresponds to the encryption algorithm that was used bythe playback apparatus when generating the encryptedcommand, so that when mutual authentication succeeded,which is to say, when the secure key in the f lash memorycard 31 matches the secure key in the playback apparatus,the **parameters** obtained by this decrypting will be the**parameters** used by the playback apparatus.On receiving a command including valid **parameters** ,the authentication region access control unit 325 accessesthe sectors **specified** by the valid **parameters** and readsthe encryption key FileKey stored in these sectors fromthe authentication region. The encryption/decryptioncircuit 327 encrypts the encryption key FileKey stored...to this encryption key FileKey hasbeen read from the non-authentication region (sc2l), theAOBisdecryptedusingthis encryption keyFileKeyandmusicis simultaneously played back.[69 70 71] **Detailed** Communication Sequence During MutualAuthenticationFIG. 71 shows the communication sequence used duringthe mutual authentication shown in FIG. 70 in **detail**. Inthis example, the flash memory card 31 and the playbackapparatus perform mutual authentication inchallenge-response format.The authorization unit 321 in the...the encryption key that corresponds to the audio object.162, A semiconductor memory card according to Claim 2,wherein each audio track further includes(1) **attribute** information and(2) link informationfor each audio object included in the audio track,the **attribute** information showing a **type** , out of **type**(a) , **type** (b) , **type** (c) and **type** (d) 1, f or each audio object,**type** (a) being an entire audio track,**type** (b) being a first part of an audio track,**type** (c) being a middle part of an audio track,and **type** (d) being an end part of an audio track,andthe link information for each audio object that is**type** (b) or **type** (c) showing which audio object followsthe audio object.
4 A semiconductor memory card according to Claim 3,
wherein the plurality of audio objects includes... ...given in the managementinformation; andlength information showing a length of the valid datathat starts from a position indicated by the offset,the **attribute** inf ormation f or an audio object showingwhether the valid data indicated by the offset and thelength information(a) corresponds to an entire...key15 corresponding to the audio object.
9 A recording apparatus according to Claim 8.
wherein for each audio object, the recording meansalso records **attribute** information and link informationonto the semiconductor memory card,the **attribute** information for each audio objectshowing a **type**, out of **type** (a), **type** (b), **type** (c) and**type** (d),**type** (a) being an entire audio track, **type** (b) being a first part of an audio track,167**type** (c) being a middle part of an audio track,and**type** (d) being an end part of an audio track,andthe link information for each audio object that is**type** (b) or **type** (c) showing which audio object followsthe audio object.
10 A recording apparatus for a semiconductor memory card,
comprising:first generatingmeans forsuccessivelygeneratingaudio frames from... ...the audio object.
14 A computer-readable storage medium according to Claim
1 3 rwherein for each audio object, the recording stepalso records **attribute** information and link informationonto the semiconductor memory card,the **attribute** information for each audio objectshowing a **type**, out of **type** (a), **type** (b), **type** (c) and**type** (d),,**type** (a) being an entire audio track,**type** (b) being a f irst part of an audio track,**type** (c) being a middle part of an audio track,and **type** (d) being an end part of an audio track,171andthe link information for each audio object that is**type** (b)

or **type** (c) showing which audio object followsthe audio object.
15 A computer-readable storage medium storing a program
which, when executed by a computer, has...encryption keycorresponding to the audio object.
19 A recording method according to Claim 18,
wherein for each audio object, the recording stepalso records **attribute** information and link informationonto the semiconductor memory card,the **attribute** information for each audio objectshowing a **type**, out of **type** (a), **type** (b), **type** (c) and**type** (d),**type** (a) being an entire audio track, **type** (b) being a first part of an audio track,**type** (c) being a middle part of an audio track,and**type** (d) being an end part of an audio track,andthe link information for each audio object that is**type** (b) or **type** (c) showing which audio object followsthe audio object.
20 A recording method for recording data onto a
175semiconductor memory card, comprisinga f... ...lEC 9293PROTECTED AREAPARTITION BOOT SE(FIG, 4A FILE ALLOCATION T@PHYSICAL LAYER ROOT DIRECTORY E@SYSTEM AREA DATA ARE)READ ACCORDING TO @ MEDIAT](**SPECIAL** COMMANDS)PROTECTED AREA USER DATA AREAONLY READABLE ACCORDING PARTITION BOOT SECTO **SPECIAL** COMMANDSBY AN AUTHORIZED FILE ALLOCATION T@DEVICEROOT DIRECTORY ElUSER DATA AREAREADINGIWRITING POSSIBLE DATA AREYACCORDING TO STANDARDATA/SCSI COMMANDSUSER...blo bg b8reservedTKI ID TKI IDENTIFIER(=A4)b7 b6 b5 N b3 b2 bt boTKENI TKI NUMBER reserved kreserved RESERVED Block **Attribute**TKI SZ TKI SIZE 'OOOB' 1 SONG IN TKI"001B" START OF SONG IN TKI"01OB" MIDDLE OF SONG IN TKITKI LNK PTR LINK POIN7ER TO "011B" END OF SONG IN TKITKI BLK ATR BLOCK **ATTRIBUTES** OF TKI "10OB" DELETED TKI"101B" TKI IN INITIAL STATETKI PB TM PLAYBACK PERIODTKI AOB ATR AUDIO **ATTRIBUTES** OF big b16 bi5 b8ISRC ISRC Audio coding mode f' bitratesb7 b6 b5 N b3 b2 bi boBIT BLOCK NORNMON TABLE Fs...ErTrack A Unused Track D of Track D of Track E TnOB001. SA AOB003. AOB005 ILIAOB004. IAOB006. @@lFIG. 30AA013-**Type** IAOI3- AOI3- AOI3- AOI3ELEMENT#1 ELEMENT #2 ELEMENT #n- I ELEMENT #nC4 FNs Ist TMSRTE FNs Middle TMSRTE FNs Middle TMSRTE FNs last TMSFIG.3013A013-**Type** 2 A013-**Type** 2AOI3- AOI3- AOI3ELEMENT #1 ELEMENT #2 ELEMENT #1FNs-Ist-TMSRTE FNs-last-TMSRTE FNs-Ist-TMSRTE=FNs-last-TMSFXKIN THIS CASE... ...FNsIS WRITTEN IN THE BITFIG. 31A PATTERN WHERE COMBINING OF AOBs POSSIBLE---- AOB#n-I + AOBifn + AOBI[n+l + AOB#n+2AOB **TYPEI** AOB **TYPE2** AOB **TYPE2** AOB **TYPEI**FIG. 31BPATTERN WHERE COMBINING OF AOBs NOT POS."AOB#n-l + AOI3#n + AOB#n+l + AOB#n+l + A(AOI3-**TYPEl** AOI3-**TYPE2** AOI3-**TYPE2** AOB- **TYPE2** AO]FIG. 32AFIRST TRACK NEXTTRACK.... AOB#n- 1 + AOB#n+l ---AOB-**TYPE1** AOB-**TYPE1**FIG.32BFIRST TRACK NEXTTRACK---- AOB#n- 1 + AOB#n ....AOB-**TYPE1** AOB-**TYPE2** FIG.32CFIRST TRACK NEXTTRACK.... AOB#n- 1 AOB#n + AOB#n+l ....yAOB-**TYPEI** AOB-**TYPE** AOB-**TYPE1**FIG,32DFIRST TRACK NEXTTRACK.... AOB#n- I AOB#n + AOB#n+l AOB#n+2AOB-**TYPEI** AOB-**TYPE2** OB-**TYPE2** AOB-**TYPE1**FIG.32EFIRST TRACK NEXT TRACKAOB#n-1 AOB#n + AOB#n+l ....AOB-**TYPE2** AOB- **TYPE2** AOB-**TYPE1**3 2 / 7 1FIG. 33A DIVISION OF Track C INTO Track C ANETKMG TKI#l TKIlf2 TKI#4 TKI115 TKI#6 Tl@Headof... ...kECOND TMSRTTMSRT entry#n New TMSRT-entry#k(size ofTMSRT entry#k + ITMSRT entry#k + 2TMSRT entry#nFIG, 39A **ATTRIBUTES** OF DPL-TK-ATR**ATTRIBUTES** CONTENT000b ONE SONG PRESENT IN ONE TKI001b ONE SONG PRESENT IN A PLURALITY OF TKIs, THIS PART BEING THE START010b ONE SONG...TK-SRP#w IN THE Default-Playlist INFORMATIONWRITTEN INTO THE TKI STORING AREA1 5TKI#z WITH THE SAMENUMBER AS TKI#z **SPECIFIED** S6ACCESS PERFORMED TO THE PROTECTED

AREAFile key#z HAVING THE SAME NUMBER AS THEAOB-FILE#z READ FROM THE ENCRYPTED KEY STORING FILEI S7File key#z INDICATED TO THE DESCRAMBLER 71FIRST CLUSTER POSITION FOR THE AOB FILE#z **SPECIFIED** IN THE DIRECTORY ENTRY S9INDI ATED CLUSTER READ FROM THE FLASH MEMORY CARDsloHNOCORRESPONDING TO THIS C1FFF"USTER INDICATED BY...AND A JUDGEMIS104 ECT FOR EDITING THE AOBs POSITIONOF BOTH TRACKS(AH es BEFORE OR AFTE RHE"Edit" S 106 or **Type2** AOBs ?TKI BLK ATR IN TKI FORINL@I-CAT@D TRACK SET AT"UNUSED" EMNo ANHES A GIVEN PA'COMBINING PROCESS INDICATED...USING THE CURSOR0 KEYS SHOWN AS OBJECT FOR EDITINGS117YesSSED THE" dit Si 19KEY ? TRACK SELECTED USING THE CURSOR0 KEYS **SPECIFIED** AS OBJECT FOR EDITING,S120PLAYBACK COMMENCED FORTRACK SELECTED AS OBJECT FOR EDITINGS121Nq..@@ I IAS @F "Mark" es122HAS T E... ...TWELTHIN THE PLAYBACK ORDERS 137k<--k+lS134Yeslist 11S 13 8Information COMPOSED OFSRP#1 TO #k THAT **SPECIFY**#1 TO TRACK#k NEWLYGENERATED AND ADDED TO THE PLMG6 5 / 7 1FIG, 66 RECORDING -@APPARATUS:00e0) 31CD@4(ADTS... ...70- --------Pcolmm READ@323 E: N, MASTER KEY SC 21 la@323b STORING UNIT 1 SC2! / DEC TION SC3SPE:304 READi I SC4**SPECIAL** AREr7N TCRY TION SC6:343 SC5DIA I EE I7MUTUAL MUTUALAUTHENTICA AUTHENTICATION(OK/NG) (OK/NG)[<-24BITS,@8BITSI... ...SC34 XOR SC44:SC46--------- ----------V V(OK/NG) (OKJNG)7 1 / 7 1INTERNATIONAL SEARCH REPORTIntt donal Application NoPCT/JP 00/03297A. **CLASSIFICATION** OF SUEWECT MATTERIPC 7 G11C7/0O G06F1/0O G06F12/14According to international Patent **Classification** (IPC) or to both national **classification** and IPCB. FIELDS SEARCHEDMinimum documentation searched (**classification** system followed by **classification** symbols)IPC 7 G11C G06FDocumentation searched other than minimum documentation to the extent that such documents are included in the fields sea ed Electronic data base consulted during the international search (name of data base and, where practical, search **terms** used)EPO-Internal, WPI Data, PAJC. DOCUMENTS CONSIDERED TO BE RELEVANTCategory 0 Citation of document, with indication, where appropriate, of the relevant passages Patent family members are listed in annex.El JA I**Special** categories of cited documents *T' later document published after the international filing dateor priority date and not in conflict with the application butW... ...document is taken alone which is cited to establish the publication date of another 'Y' document of particular relevance; the claimed invention citation or other **special** reason (as **specified**) cannot be considered to involve an inventive step when the Now document referring to an oral disclosure, use, exhibition or document is combined with one ...

17/3K/26 (Item 26 from file: 349)
DIALOG(R)File 349: PCT FULLTEXT
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00579182

METHOD AND SYSTEM FOR REGISTERING AND LICENSING WORKS OVER A NETWORK
PROCEDE ET SYSTEME PERMETTANT D'ENREGISTRER DES OEUVRES DE L'ESPRIT ET DE CONCEDER DES LICENCES RELATIVES A CES OEUVRES SUR UN RESEAU

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AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR,
BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM,
EE, ES, FI, GB, GD, GE, GH, GM, HR, HU,
ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ,
LC, LK, LR, LS, LT, LU, LV, MA, MD, MG,
MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU,
SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT,
TZ, UA, UG, UZ, VN, YU, ZA, ZW, GH, GM,
KE, LS, MW, SD, SL, SZ, TZ, UG, ZW, AM,
AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE,
CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
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CI, CM, GA, GN, GW, ML, MR, NE, SN, TD,
TG

Language Publication Language: English

Fulltext word count: 26451

Detailed Description:

...format for the information is.

MMI, TERR, TYPE, RIGHTS, SOURCE, COPY,
where: MMI is the Song Identifier, TERR is the territory code (See Code Tables), **TYPE** is the code for the rights **type** (see Code Tables), RIGHTS is a word describing the rights, and SOURCE is the agency or society code for the rights source. If the Publisher ... ...the SOURCE contains the Account/Owner ID. COPY contains the code to indicate whether a copy of the request should be sent to the Publisher.

Special Proforma Clauses: This field contains clauses that are to be used in any license involving this work.

The format of the information is.

TYPE, CLAUSE, TEXT,
where **TYPE** is the license **type**, CLAUSE is the clause to be replaced, and TEXT is the language of the new clause to be used.

D. Online registration with that Account... ...elements in the following order, reading from left to right.

31
MML Title, Alt title, Show/Movie, Writers, Arrangers, CAE, Usage Note,
Link to Audio **Sample**, Link to Additional information, Link to Discography,
Link to Lyrics, Link to Score, Account ID, Publisher, Catalog, HFA
License, Rights Source Information.

A batch file...HFA# HFA Account Number
B. Uses
Based on the information entered in the Rights form, the system indicates which uses the requestor has selected. The **types** of use are.

Audio 500+
Audio Under 500
Chip
Music Box
Toy
Download Permitted
Streaming Audio
Play On Web Page
InternetBroadcast
Karaoke
Game
CDROM
Kiosk... ...system concludes that the associated rights will be required. For example, if the user says that he plans to make a record, and provides information **specific** to the record - such as Audio 500 + -- the system looks across the rights indicators and ...for this application - e.g. Mechanical, Synch, DPD.

The second task is to determine which publishers or organizations must grant those rights, based on the **type** of rights required and the territory in which the record is manufactured, or where the program is produced, or where the performance will take place... ...IBLS system, we will assume that the country in all cases is the United States. The system then sets up a search.

MMI, Terr = US, **Type** = Mech, **Type** = Synch, **Type** = Perf,
Type = DPD, **Type** = Print, **Type** = Grand, **Type** = Master.

There is only one Terr =field, but there may be as many as seven **Type**= fields for situations where the user will require many different licenses.

The system begins by searching the ownership database, which is structured as follows.

....

....

.. ..

.....

.....

....

....

....

Dialog eLink: Order File History
17/3K/27 (Item 27 from file: 349)
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00535361

MUSIC ORGANIZER AND ENTERTAINMENT CENTER
EQUIPEMENT DE DIVERTISSEMENT ET DE CLASSEMENT DE SELECTIONS MUSICALES

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[EP] AT; BE; CH; CY; DE; DK; ES; FI; FR; GB;
GR; IE; IT; LU; MC; NL; PT; SE;

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English Abstract:

...music is provided in data-compressed form and is decompressed and processed through a sound card during playback. The categories can include a variety of **parameters** such as title, artists, date, speed, dance **characteristics**, subjective energy level and music **style**, such as easy-listening, **upbeat**, etc.

French Abstract:

...compressees qui sont ensuite decompressees, et traitees par l'intermediaire d'une carte son pendant la lecture. Les categories peuvent comprendre une grande variete de **parametres**, tels que titre, artistes, date, vitesse, caracteristiques de danse, niveau subjectif d'energie et **style** de musique tel que musique legere ou musique rythmee.

Detailed Description:

...in one place, and to radically alter the presentation of this music. In addition to the actual music sound data, new data related to certain **characteristics** of the music can now be overlaid in the storage media. This enables a listener to organize and playback music in a highly customized manner... ...stored on magnetic disc and optical media than previously. The "Red Book" format common to music compact discs is somewhat inefficient due to its slow **sample** rate, and a much larger amount of data can be compressed on a standard data optical disc (CD-ROM), and decompressed and replayed using any... ...is a further object of this invention to provide a user with the ability to fully customize playback of music according to a variety of **parameters** including categories of music. The graphical presentation of playback and storage controls should be easy to use and learn, and should take advantage of color...music is provided in data-compressed form and is decompressed and processed through a sound

card during playback. The categories can include a variety of **parameters** such as title, artists, date, speed, dance **characteristics**, energy level and music **style**.

The user selects between a variety of graphical user interface screens that are arranged on a display. The display can comprise a touch screen, or... ...forming the database for compressed music data and categories. The music is preferably compressed using MPEG3 and a standard sound card, typically having high-fidelity **characteristics** is used to playback the decompressed music. The music is stored in a hard drive or other highvolume storage medium on the system in compressed... ...ROM can include updates to the master list that are loaded along with the songs.

The CD-ROM and/or individual songs can include a **special** code or
identification that is keyed to the user's system's code. In this manner only the user's system can load the songs ...playback.

BRIEF DESCRIPTION OF THE DRAWINGS
The foregoing and other objects and advantages of the invention will become more clear with reference to the following **detailed** description, as illustrated by the drawings in which.

Fig. I is a perspective view of an exemplary music organizer and entertainment
center according to an... ...of a first graphical user interface screen;
Fig. 12 is a plan view of a second graphical user interface screen;
Fig. 13 is a more- **detailed** plan view of the second graphical user interface
screen of Fig. 12;
Fig. 14 is a more-**detailed** plan view showing the saving of music play list
selections using the graphical user interface screen of Fig. 12;
Fig. 15 is a more-**detailed** plan showing the loading of a music play list using
the graphical user interface screen of Fig. 12;
Fig. 16 is a plan view of...including, for example, the
docking element shown in Fig. 20;
Fig. 23 is a plan view of the graphical user interface screen of Fig. 12 **detailing** a
favorite hits function;
Fig. 24 is a plan view of the fourth graphical user interface screen showing a
display of the service provider's... ...exit function; and Fig. 28 is a plan view of the graphical user interface screen of Fig. 27 showing a shut-down time control window.

DETAILED DESCRIPTION OF
A generalized embodiment of a music organizer and entertainment center 50 as **detailed** in Fig. 1. For the purposes of this description the term "center" will be used to describe any of the music organizer and entertainment center... ...extending outwardly and retracting inwardly based upon a switch 64. The transport mechanism and reading mechanism can be conventional. The center includes a Rip-up **type** display 70 according to this embodiment. The display is located on the top 72 of the center and is retractable into a recess 74. A...as a track ball, can be provided to the
,9
chassis 54.

With reference to Fig. 2, an alternate embodiment of a center 90 is **detailed**.

This center comprises a laptop arrangement having a base 92 and a foldable display section 94. This center can comprise, in essence, a modified laptop computer with all the basic components of a modem multimedia computer system. Certain personal computer components not **specifically** required for the purposes of this embodiment can be omitted. For example, a display 96 having buttons 98 as described above can be provided. A... ...provided by a power cord I 1 0. Note that automotive DC current can also be used.

The generalized architecture of a center is further **detailed** in Fig. 3, complete with optional components. The "heart" of the center is its central processing unit or
CPU 130. The CPU, in a preferred...21 0, a sound information database 220 the center's proprietary speech vocabulary 230 and the center's search and play interface 240.

A significant **feature** of the center, to be described in greater **detail** below, is the organization of individual songs or selections according to **specific** categories, that are determined ahead of time, on a partially subjective basis, by the service provider.

These categories are carried in a database, along with the raw digital music data, and allow the user to playback each of the individual selections based upon **specific** categories in a random or ordered manner. The use of categories for storage and playback empowers the user in an entirely new way. Songs can be chosen based upon a **specific** desire or **mood** that relates to categories such as music age, energy, speed, **style**, dance, or rating. Experienced listeners can enjoy new convenience in music playback. Newer listeners typically find their use of the center to be highly educational, as they quickly learn to associate certain **types** of categories with **specific** selections, artists and songs, and can enjoy the benefit of a full display of the song data via the center's screen.

With reference to...be used in conjunction with the database program to catalog each individual musical selection-song title, artist, date, main music category, sub-main music category, **special** music category, sub-music category, music **style**, dance **type**, music speed and a subjective music "energy level" determined by the service provider.

These categories are used subsequently by the center's operating system as...conventional installation and instructions provided with the disc. As noted, the center either includes well known CD-ROM installer routines, such as those found in **popular** WindowsS operating system available from Microsoft or, alternatively, **specialized** installation software is included with the disc transferred from the service provider. All data on the disc is typically transferred into the high-volume hard... for example, play, stop, pause, forward and reverse. Additional controls 346 can also be provided for the channels and can be used, for example, for **specialized** functions such as mixing of songs and overriding of songs using, for example, external microphone inputs. Note that, in particular, a fade control 348 is provided.

Fig. 5 **details** user operations utilizing Screen2 after branching from step 350.

Screen 2 is shown generally in Fig. 12, as noted above. By branching to the searching...user is then prompted to input an appropriate time duration within which music will be played in block 418 based upon button 420. Given these **parameters**, the system accesses the database in step 422 to determine music matching, the selected criteria for time and category. Songs are entered in a play... ...In particular,

according to block 428, the songs can be randomized after the time and category criteria have been met to provide a "disc-jockey" **type** playback which is somewhat arbitrary. The play list for the given time is **detailed** in window 430. The 1 5 number of songs in the play list currently remaining as shown in window 432 and the time remaining is... ...time, a portion of the current search list 451 is displayed, showing the various depicted categories such as title, artist, publication date, music category music **style**, dance **type**, music speed and energy in row-and-column form. The search list represents the selections located by pressing one or more category buttons. Songs from ...by pressing either ascending or descending buttons 455 and 457, respectively, the search results can be displayed in corresponding order.

Another button of interest as **detailed** in Fig. 13 is the "dance mix" button 452.

This button is a default selection button that selects and searches for dance music having a particular speed. In a preferred embodiment, this function **specifically** selects, at random, from the MyData database three dance category songs having with a fast speed category followed by two dance category songs having a... ...by pressing the open button 464 within the window 460.

Before discussing the system procedure further, it is noted that pressing the category button as **detailed** in step 41 0 (Fig. 5) twice (e.g., "double click") as shown in block 470, causes the particular category button to display Screen3 480 (Fig. 16). The display of Screen3 is **detailed** in block 472. Screen 3 provides a window 482 with subcategories that fall under a particular music category. The sub-categories are listed as individual buttons 484. These categories can comprise a variety of **parameters** such as time frame, **special** occasions, **type** of music, etc. In addition, the basic categories such as speed or "energy" can be included as sub-categories under a particular category.

Further reference is made to Fig. 6. The controls for screens 2 and 3 will be described first, in further **detail**. When a particular song in a play list is selected by, for example, highlighting a song with the cursor as **detailed** in block 500, the song can be played immediately by pushing the Now button 502 as **detailed** generally in block 504.

Any current song being played is interrupted in block 506 and the selected song is played instead. Subsequently, the play list...is shown in the search window 332. Note that the search window 332 displays various category information such as title, artist, date, music category, music **style**, dance **type**, music speed and energy. Of course, this can also be included as desired by the service provider who originally forinats such categories. In addition, custom song number 558, the title 590, the artist 592, the music **style** 594, the dance **type**, if any, 596, the speed 598, the time in seconds 570, the energy level, if any, 572 1 5 and any other appropriate category.

The...cleared in block 630. The system awaits further instructions at this time.

Fig. 1 0 describes the saving and loading of play list in more **detail**. If a save command is initiated by the user in block 650, then all song data and associated colored data for the display from the... ...The user can select an appropriate file name for saving the particular play list file in block 656. Again, the display for this procedure is
detailed in Fig. 14
If a load command is entered by a user as shown in block 660, then the file load window is displayed

in... ...and the current play list is updated and/or replaced with all song in color data from the loaded file in block 666.

It is **specifically** noted that category information is provided by the service provider appended to each song in the database. The accessing of songs having such data appended... ...embodiment, is hereby, incorporated into the instant application by reference in its entirety.

Using the hardware and software elements described above, Figs. 18 and 19 **detail** a docking mechanism in which music is stored on a hard drive or other electronic medium in a main data handling unit 700 with a...back to the main audio unit 784 where amplification occurs. The music is played back on appropriate speakers 794.

Reference is now made to additional **features** that can be implemented according to certain embodiments of the invention. Fig. 23 **details** a favorite hits function that can be applied to Screen2. The display 795 includes a favorite hits category creation button 796. Favorite hits, when identified... ...can be transferred to the play list for playback in a desired order (typically first-in-firstout) by simply clicking or-double clicking on the **specific** search list song entry.

Figs. 24, 25 and 26 **detail** an alternate view of Screen4, as discussed above. The display 800 includes an overall listing of the selections available from the service provider. A list... ...selections are delivered from the service provider. The category fields described above are provided for each title 801-namely, artist 802, date of publication 804, **specific** music category 806 (e.g. " **rock**," "jazz," "**alternative**," etc.), **music style** 808, dance **type** 810, music speed 812 and energy 814. In addition, an ownership column 816 is provided that indicates whether the music data accompanying the title is... ...for certain listeners due to content are appended with a rating, as appropriate. In this example, all songs not rates are acceptable to all. A **specific** rating letter such as "G" can also be placed next to such songs in the column 818. Higher rated songs can include ...disabled using a password that is entered after striking the password button 824 in the window 822. This button calls a password-entry window 826, **detailed** in Fig. 26.

Once an initial password is entered, it must be reentered to change the rating blocking function or to change the password itself... ...In the case of music videos, most or all of the same categories as music can be used, with the addition, perhaps of certain video- **specific** categories.

A sufficiently large hard-drive can be used to store a large database of movies and/or other video data. Where storage is problematic...handles video data using the underlying interface and organizational structure of the present invention.

Note that the graphical user interface herein has been described in **terms** of its primary functions. Any buttons on the display screens **detailed** herein not expressly described can be assumed to perform functions that are straightforward, and particularly noted on the buttons themselves, such as "OK and "Cancel." All ftinctions not **specifically** described should be clear to those of ordinary skill.

The foregoing has been a **detailed** description of a preferred embodiment of the invention. Various modifications and additions can be made without departing from the spirit and scope of this invention... ...in the display can also be varied. Again, it is expressly contemplated that particular category buttons

on Screen2 are displayed in different colors, and that **specific** colors can be used to highlight certain windows or underlying selections in a display, as well as the status of various functions. Accordingly, this description...

Claims:

...are selected and listed on the display.

7 The center as set forth in claim 6 wherein at least one of the displays includes a **play** list of **music selections** chosen from the **search** list, the center being constructed and arranged to translate compressed data of each of the music **selections** on the **play** list, in a predetermined order, and to convert the playable digital music data into audible music signals.

8 The center as set forth in claim... plurality of display screens, at least one of the screens showing thereon a plurality of buttons associated with individual of the associated category flags, a **playback** list showing music **selections** schedule for **playback** by the center and a **search** list showing current **music** selections retrieved based upon predetermined of the category buttons.

13 The center as set forth in claim 12 wherein the graphical user interface comprises a...

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00511638

METHOD AND APPARATUS FOR COMPOSING ORIGINAL MUSICAL WORKS
PROCEDE ET DISPOSITIF PERMETTANT DE COMPOSER DES OEUVRES MUSICALES ORIGINALES

Patent Applicant/Patent Assignee:

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CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN,
IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,
LS, LT, LU, LV, MD, MG, MK, MN, MW, MX,
NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI,
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YU, ZW, GH, GM, KE, LS, MW, SD, SZ, UG,
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AT, BE, CH, CY, DE, DK, ES, FI, FR, GB,
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English Abstract:

...in a database as metrics, or targets for the composition of new pieces. The present invention composes a new piece of music by, for example, **specifying** component musical **features** in the selected targets that should be modified or retained in creating the new work. Such musical **features** include, for example, rhythmic **characteristics**, harmonic **characteristics**, and the like. In this manner, a user who is musically untutored is able to create satisfying, original works having desired characteritics as **specified** by the user.

French Abstract:

...des elements musicaux existants et a leur appliquer des modules de modification. Des selections musicales existantes resident dans une base de donnees sous forme de **parametres** ou de cibles servant a realiser la composition de nouveaux morceaux. L'invention permet de composer un nouveau morceau de musique au moyen, par exemple...

Detailed Description:

...composition tools that assist in the creation and
composition of musical works,

BACKGROUND OF THE INVENTION
Music is a universal metaphorical language capable of communicating **moods**, **emotions** and other artistic sentiments to listeners. Heretofore it has been impossible to use the immediate reaction of a listener to aid the music composition process.

Instead, in order to understand the elements of a musical selection that are capable of evoking **emotional** reactions in a listener, a person interested in composing music endeavor.

Prior art computer-based music composition tools that attempt to assist the composition process... ...in digital form, and combining them into musical passages and entire pieces. However, such sequencers are limited in that the user is required to fully **specify** all musical **parameters** such as rhythm, harmony, melody, and orchestration without any help from the program.

difficult to control.

EMI, or Experiments in Musical Intelligence, developed by Dr... ...pieces of works by famous composers and is then able to create imitations of their work. EMI has been used to create compositions in the **styles** of Bach, Beethoven, Chopin, Rachmaninoff, Mozart, and Stravinsky. The approach of EMI is rule-based and uses pattern-recognition algorithms. This tends to create music which sounds stiff and often nonsensical, with oddly-formed melodies and harmonies. In order to achieve acceptable results, one must have **detailed** knowledge of musical theory.

U.S. Patent No. 5,663,517, issued September 2,1997 to D. V. Oppenheim, for "Interactive System for Compositional Morphing... ...sets of elements from each of a first and second musical sequence, grouping the paired sets, and assigning morphing and transformation factors to generate a **parameter** for a new event. Thus, the technique of Oppenheim is relatively limited and inflexible, as it can only generate "morphs" that result from identified paired...offers a finite number of riffs, and tends to produce music which is repetitive. The program generates accompaniments, harmonies, and solos in a variety of **styles**, once the user has entered **specific** chords. Thus, the user must have a good understanding of music, and enter the chords him- or herself.

Koan Pro 2, from SSEYO, allows a... ...difficult to control.

The results tend to be mechanical sounding. Moreover, this product requires the user to have compositional skill in balancing the rules and **parameters** needed to create music.

Song Construction Kit, from The Sound Factory, lets users build songs by
pasting and mixing fragments of digital audio. Users can select from several musical **styles** such as **rock**, rap, grunge, dance, **blues**, country, funk, and generic **pop**.

However, the implementation is limited, and it is extremely difficult to create any 2o kind of chord progression.

Some programs which enable non-musicians to... ...as the Microsoft@ Music Producer from Microsoft Corporation, rely on nonmusical adjectives to describe various aspects of the music. For instance, the user might use **terms** like "**happy**," " **aggressive**," 'hypnotic,' or 'perky" to describe harmonic and

rhythmic elements. But using adjectives to determine musical elements leads toward simplistic-sounding music, since what often gives music a particular character is the combination of elements which may or may not share the **characteristics** of the overall piece. A particular harmonic combination of some "**happy**" bass line and some "optimistic" piano part might add up to a bittersweet musical surface. A slow, **heavy** drum part might actually sound more **aggressive** in certain
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SUMMARY OF THE INVENTION
In one embodiment, the present invention comprises the following elements: a computer database for storing **sample** musical selections to be used in composing music; a graphical user interface (GUI) for **displaying** available musical **selections** to be used in composing music, for displaying compositional strategies, and for displaying the immediate results of the compositional process as the **user** composes **music**; **input**/output devices for receiving commands from a user, for auditioning **sample** musical selections available for use in composing music, and for playing back the music composition work-in-progress as it is composed by the user... ...composition process.

The computer database stores hundreds of musical selections that may be used as starting points by a user composing music. The graphical user **interface displays**.

available music **selections** for use in composing music, catalogued according to musical **genres** and musical **characteristics**; music composition strategies available to a user; and the intermediate results of the music composition process in a flowchart or node/ tree format. The graphical...later use if it appears to be a promising starting point. One embodiment of the invention also has automated search and substitution facilities that automatically **search** the **music** database for suitable musical selections to substitute for other musical selections thereby greatly simplifying the compositional process.

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selection.

Another **feature** of the present invention automates the fragmentation of a selected complex musical selection into a series of distinct parts. This **feature** catalogues each of the parts comprising the complex musical fragments so that various musical operations including, for example, substitution of other music in place of a constituent part can be accomplished. Selection of suitable music selections for substitution is automated by a **type** of virtual zone called a shark which is used to find pairs of excerpts in the database which are close enough in role and rhythmic ... ...Fig. 2 is a block diagram depicting the software environment in which the present invention operates.

Fig. 3 is a flowchart depicting the rhythmic attractor **feature** of the present invention.

Fig. 4 is a flowchart depicting the element of the present invention that creates an attack **vector**.

Fig. 5 is an illustration showing the relationship between a **sample** musical fragment and its corresponding attack **vector** representation.

Fig. 6 is a flowchart depicting the element of the present invention that creates a resonance **vector**.

Fig. 7 is a flowchart depicting the element of the present invention that determines the resonance

between two passages of music.

Fig. 8 is a... ...element of the present invention.

Fig. 9 is a flowchart depicting a method of selecting a best pitch according to the present invention.

an harmonic **vector**.

Fig. 10a depicts a graphic representation of four consecutive harmonic **vectors** created for four consecutive positions in a musical fragment.

Fig. 11 is a flowchart depicting the element of the present invention that creates a PC **vector**.

Fig. 12 is a flowchart depicting the functional operation of the groove attractor element of the present invention.

Fig. 13 is a flowchart depicting the functional operation of the groove filter element of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Definitions

Prior to describing operation of the present invention, a number of concepts relating to the invention will be explained.

Notes: The smallest musical unit referenced in the system is the note. A note has certain defined **characteristics**, such as pitch, attack, and duration. Generally, notes are not individually manipulated by the user. Rather, operations in the system are typically performed on groups... ...from a single instrument. Each part is capable of outputting a list of notes (note list) representing the musical passage associated with the part.

Several **specialized types** of parts are defined, each of which performs a particular role. Parts can be elements,, nodes, or agendas. As will be described below, elements are... ...on one or more other nodes, which may be referred to as source nodes.

Nodes are linked together in a web of source connections.

Different **types** of nodes use different algorithms for generating their results. A simple example is a TimeScale node which can speed up or slow down a passage... ...of a copy of the result of one source node to become more like the rhythm of the result of the other source node. Each **type** of node can have any number of sources.

Virtual zones: a virtual zone is a **type** of node used to introduce musical material into an agenda. Virtual zones act as placeholders in configurations of agendas within the program. All nodes which... ...s output. At the beginning of each strand of nodes is a virtual zone, which are the only nodes with no source. Virtual nodes are **special** nodes which contain a copy of the output of some part which is not a node.

Virtual zones typically have their potential zones loaded with...an
embodiment of the present invention, designated as system 100. Many of the elements and components shown in Fig. 1 will be described in more **detail** in connection with the other figures. The arrangement of components shown in Fig. 1 is merely exemplary, and one skilled in the art will recognize that the various components shown therein could be arranged in many different configurations without departing from the spirit or essential **characteristics** of the present invention.

MacOS CPU 102 represents a computer running the Macintosh Operating
System, version 8.0, from Apple Computer. A preferred embodiment of... ...invention is implemented to run on a 200 MHz or better 604e Macintosh computer, with at least 96 Mbytes of random-access memory (RAM). Other **types** of computer hardware could also be used.

The operating system is enhanced by installation of a MIDI driver such as MidiShare 122, a widely-available... ...MIDI interface to two devices: a Roland JV1080 synthesizer 103 (which has Roland Vintage Synthesizer and Roland Orchestral expansion boards installed), and an Akai S2000 **sampler** 104 containing 32 Mbytes of RAM for storing **samples** of musical selections. The **sampler**
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to the kind of music the user wants to create. Groove filter 112 then does the work of selecting from the elements pool a... ...and rhythmic attractors.

Contextual attractor 114 operates as follows: First, it finds an optimal mapping between groups of source and target, by comparing known structural **features** such as phrasing. Next, it modifies the source groups so as to make them more similar to the target groups, in **terms** of the structural **features**. In doing so, contextual attractor 114 draws ...within its source group, and that source group's corresponding target group.

One skilled in the art will recognize that contextual attractor 114 is a **feature** which is included in one embodiment of the present invention, but which is not necessary to practice other embodiments of the invention.

Harmonic attractor 115... ...and brings the
harmonic target and the harmonic source into that agenda. The user creates a harmonic attractor 115 (as will be described in more **detail** below). The user **specifies** the target distance, which is a **specification** of how closely the source is to follow the harmonies represented in the target. Other values of the harmonic attractor 115 may be left to... ...piece now has a coherent harmonic character, which contains the harmonic essence of his chosen harmonic target, while retaining all of the rhythmic and timbral **features** of his original harmonic source.

Output of harmonic attractor 115 is patched in parallel to three nodes: chord substitution node 116, which further alters harmony ... ...a sense of musical development or evolution over time. Invert pitches node 125 is also patched into sequencer 119, as will be described in more **detail** below.

Virtual zone 110 sends notes to fragmenter 123 which shuffles and repeats small subsections containing groups of notes. Output from fragmenter 123 is patched into harmonic attractor 124, which has a harmonic target **specified** by user 101. In this case, the target is a shark, which is a **type** of target capable of performing automatic

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searches on database 107, as will be described in more **detail** below. The user is able to select criteria (rather than a single musical fragment), and the shark target then finds candidates in database 107 which best match the **specified** criteria.

Output from harmonic attractor 124 is provided to invert pitches node 125, which doubly-distorts the modality of the notes. Output from node 125...118 as was described above.

Output from sequencer 119 is passed to repeats node 120, which loops the
musical sequence a number of times, as **specified** by the user. Output from repeats node 120 is passed to sequencer 121, along with output from groove attractor 126.

Groove attractor 126 is an... ...musical way, e.g., according to canonical patterns of musical structure, in order to create a complete musical passage. The user runs the sequencer, adjusting **parameters** until he is satisfied with the output.

The final sequence is provided to the user via MidiShare 122 and computer 102.

As stated above, the employs well-known techniques of object-oriented design. Elements of musical design are implemented as objects which are a combination of **attributes** and roles. More generic objects are refined into more **specific types** of scales through **specialized** subclasses. For example, a scale object is refined into a diatonic scale in such a manner. Polymorphism is used throughout the software architecture to provide **specific** behaviors for widely used musical interactions between varied objects. Encapsulation is an important element of the invention's approach to musical form. Combinations of musical... ...in the creation of higher level combinations of design elements. This kind of encapsulation is evident in the user interface as it is used to **specify** the level of **detail** desired by the user for a particular task.

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System Elements
The above-described elements of the preferred embodiment of the invention will now be described in greater **detail**.

Rhythmic At-tractor
Rhythmic attractor 127 is a device used to cause one collection of notes (the source) to more closely manifest the rhythmic character... ...The io beginning of each note in the passage is called an attack. The attacks for each passage are represented by a sixteen-bit binary **vector**, where each bit represents a corresponding time-ordered sixteenth-note position in the passage. Each bit is set to 1 if a note attacks at that sixteenth-note position, or 0 if no note attacks at that position.

The resonance between attacks in the attack **vector** is then calculated using the binomial measure (described below) to amplify the relative importance of attacks related by both time proximity and beat strength. For instance, a syncopated note his source notes.

In step 401, the user also **specifies** a rhythm length, which represents the span of time over which the invention will modify the notes; a beat division which **specifies** the number of subdivisions of the basic

beat which should be represented (this can be thought of as the level of quantization of time); and... ...more nearly the source will be made to emulate the rhythm of the target.

In step 402 the source notes are translated into an attack **vector** representation.

This is a **vector** designed to capture the distribution of attacks (beginnings of notes).

This attack **vector** is then translated by step 403 into a resonance **vector** representation. This is a **vector** which represents the attack times of a group of notes, with a structure designed to emphasize the strong and weak relationships among different attack times against a regular musical meter.

Next, in step 404 the target notes are translated into attack **vector** representation. This is a **vector** designed to capture the distribution of attacks (beginnings of notes). Then this attack **vector** associated with the target notes is translated into a resonance **vector** representation, as was the source attack **vector** in step 403.

System 100 then determines, in step 406, the current distance between the two resonance **vectors**. This distance is a measure of the proximity, or relatedness, of the
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which will now be described in turn.

The source attack **vector** consists of O's and 1's, with each 0 or I representing the absence or presence of a note attack (beginning) at a particular... ...of time. Each position may also be referred to as a bit. Starting from the left-most position (index 0), system 100 moves through the **vector** one position at a time. For each position in the source **vector**, system 100 performs steps 407 to 413.

System 100 in step 409 toggles the value of the bit at the current position. In musical **terms**, this means we are adding or deleting a note attack at the point in time corresponding to our current position in the attack **vector**.

In step 410, system 100 creates a resonance **vector** on the modified attack **vector**. Next,, in step 411, system 100 measures the **vector** distance between the modified source and target **vectors** to determine if the change made to the source causes the source to move closer to the target in the space represented by these resonance **vectors**. **Vector** distance may be determined, for example, by Euclidean distance measures, as will be described in more **detail** below.

In step 412, system 100 determines if the current **vector** distance is less than the user- **specified** minimum distance. This determination indicates whether or not the modification has in fact moved the source music selection closer to the target music selection. If it has, system 100 preserves this change to the source attack **vector** (step 413). If the change failed to move the source closer to the target,, the invention restores the source to its original value (step 414). Then the invention repeats the previous steps 407 to 413 on the next position to the right in the source attack **vector**.

If the modification is successful, the modified source attack **vector** now
represents a rhythmic profile which was derived from the original source, but which has been iteratively manipulated until it comes within a user- **specified** distance from the target. Next,, in steps 415 to 420,

system 100 cycles through this modified attack **vector**,, converting from its simple representation back into notes.

System 100 returns, in step 421, to the beginning of the source attack **vector**. In step 415 it moves through the new source attack **vector** from left to right, looking for
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Attack **Vector**
Referring now to Fig. 4, there is shown a flowchart depicting the steps that the invention performs to create an attack **vector**, as referenced in connection with steps 402 and 404 in the above description. An attack **vector** is a representation ...which correspond to the presence and absence of note attacks. Referring also to Fig. 5, there is shown an illustration depicting the relationship between a **sample** musical fragment 521, and its corresponding attack **vector** representation 522.

Initially, in generating an attack **vector**, system 100 obtains a list of notes which are to be represented. System 100 also obtains a rhythm length, which represents the span of time over which the program modifies notes, and a beat division which
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vector.

System 100 initializes, in step 502, an N-length zero **vector**: a **vector** filled with the number 0. Each position in the **vector** is able to hold a bit having a value of 1 or 0.

N (the size of the **vector**) is determined by multiplying the rhythm duration by the beat division. System 100 begins in step 503, with the first note in the note list... ...steps 504 to 509, system 100 moves through the list of notes. For each note, in step 504, it determines the position in the attack **vector** corresponding to the attack time of that particular note. The position is determined by multiplying the note's attack time by the beat division, rounded to the nearest integer. After checking, in step 505, that this position is contained within the **vector** size, system 100 sets, in step 506, the bit in the position to the value of 1. If, in step 508, there are more notes... ...step 509, to the next note,. and returns to step 504. Thus, for every note in the list, the program places a 1 in the **vector** at the **vector** position corresponding to that note's attack. Once all notes have been processed, system 100, in step 507, returns the attack **vector**.

Resonance **Vector**
Referring now to Fig. 6, there is shown a flowchart depicting the steps that the invention performs to create a resonance **vector**, as referenced in connection with steps 403, 405, and 410 in the above description. A resonance **vector** is an advanced representation of rhythmic data, that is derived from an attack **vector** in the following manner.

Initially, system 100 obtains an attack **vector** (as described above in connection with Fig. 4), rhythm length (which represents the span of time over which to modify notes), and a beat division (which **specifies** the number of subdivisions of the basic beat which should be represented). Generally, the rhythm duration and beat division have the same values as the corresponding **parameters** used in the creation of the attack **vector** as described above in connection with Fig. 4.

System 100 initializes, in step 602, an N-length zero **vector**: a **vector** filled with the number 0. Each

position in the **vector** is able to hold a value from 0 to some
...is shown a flowchart depicting a method for determining resonance between two attack times, as performed in step 610 of Fig. 6.

The Resonance Between **feature** determines a value that can be determined for any two attack times. The higher the value, the greater the relationship between the two
22
attack times. The value of Resonance Between is a function that varies with both linear proximity, and proximity in **terms** of the metric notion of beat strength.

In step 701, system 100 obtains a rhythm length, which represents the span of time over which the invention modifies the notes, and a beat division, which **specifies** the number of subdivisions of the basic beat to be represented. System 100 also obtains two attack times, designated attackl and attack2, representing **specific** notes to be compared in order to determine a resonance value.

15/3K/7 (Item 7 from file: 348)
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Apparatus for reproducing music and displaying words.
Vorrichtung zur Wiedergabe von Musik und zur Anzeige von Worten.
Dispositif pour la reproduction de musique et l'affichage de mots.

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Specification: ...processed by said operating means, and then amplifying the analog signal thus obtained; and a display device (17) for visually representing the words thereon.

The **public** communication line is defined here to imply both an analog telephone line and an ISDN-standard digital line.

In this **specification**, "composite music data" signifies binary-coded data including instrumental music play, words and file data; "instrumental music data" signifies binary-**coded** data of the instrumental music play; and "words data" signifies binary-coded data of the words, respectively.

Any other objects, **features** and advantages of the present invention than those mentioned above will be more apparent from the following **detailed** description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

The accompanying drawings show preferred embodiments of the present invention, in which:

Fig. 1 is...the keys by a player, stepping or releasing the pedal for musical effects, or on-off action of the switch to designate a desired tone. **And** such operations are analyzed as quantitative numerical values and converted into digital signals, whereby objective digital data are obtained. The **details** of such digital data will be described below.

(1) Musical note data

The musical note data is composed of converted digital values representing which of...number.

(b) Repeat command

A command for indicating the end of repetition and designating the label for return and the number of required repetitions, thereby **setting** the label number and the number of repetitions.

(c) Conditional repeat command

A command for designating shift to another **specified** label after completion of the operation by the repeat command. On the musical score, this command corresponds to a parenthesis.

(d) Time pattern command

A... ...basic unitary length of the lapse time. Therefore, the tempo becomes slower in accordance with increase of the numerical value.

(f) End command

A command **for** indicating the end of reproduction of one musical piece or song. The end is represented by previously inputting a **specific** numerical value.

As for decision of the standard lapse time and the scale, calculations are executed on the basis of the clock frequency obtained from... ...be greater than 127 for realizing the desired expression of the various effective sounds mentioned above. As for the basic unitary time of musical notes, **the** length is set to 10.24 msec and its integral multiple is utilized.

The individual commands are designated by **specified** numerical values, respectively. Any of such numerical values is not restricted to a single **one** alone, and it is a matter of course that the amounts of data can be reduced by omitting some **specified** commands depending on the storage capacity of the host computer 11 or that of each terminal apparatus 13.

Fig. 5 is a block diagram showing... ...the CPU 22 and generating clock pulses of a predetermined frequency used to drive the CPU 22 while being utilized as a basis of the **musical** tempo or as a reference to determine the scale. The clock generator 25 is not limited to such internal **type** alone, and any external clock means may be employed as well. Further shown are a volume D/A converter 26 for converting into an analog... ...27 respectively. Denoted by 28 is a scale control frequency divider for demultiplying the frequency of the clock pulses obtained from the clock generator 25, **thereby** producing a desired frequency which corresponds to the designated scale in the music data. The frequency divider 28 is **driven** by the data inputted thereto from the internal **interface** 23. There are further shown waveform memories 29 for storing digital data obtained by sampling, analyzing and digitizing the **characteristic** analog **waveforms** of individual string or wind musical instruments. Each of the waveform memories 29 stores the sampling waveform of a **specific** musical instrument individually, and a plurality of such memories are existent in mutually equivalent relationship. When a control signal is fed from the CPU 22... ...the case of scale data, it is inputted to the scale control frequency divider 28, which then generates a signal of the demultiplied frequency determined **in** conformity with the clock pulses. If the received data is composed of the signal for determining the tone, the **specific** sampling waveform stored in the memory 29 is fed to the waveform D/A converter 30, and the analog signal obtained therefrom is outputted to...to be reproduced.

Fig. 6 graphically shows the analog unitary sampling waveform stored in the memory 29. Such waveform comprises an initial portion A and **a** repetitive portion B. That is, the waveform of each kind of musical instruments can broadly be classified into two **characteristic** forms. In the case of a piano, for example, one peculiar waveform is derived from an impact sound emitted by a piano wire and a...a public communication line becomes expensive in case the data base is dependent entirely on the host computer, this embodiment is so contrived that any **music** pieces or **songs requested** frequently are stored on the terminal apparatus side, and the music data are loaded therefrom to curtail the expenditure of using the communication line. The term "optical disc" is not limited **to** a nonwritable CD-ROM alone, and includes a readable/writable CD-RAM and further an optical disc of another **type** that permits additional storage merely once.Denoted by 81 is a CD-ROM disc having a diameter of 12 cm and a storage capacity of... ...controlling the same and loading one or more retrieved music data in the RAM; an input unit 84 (normally with a ten-key device or **the like**) for inputting the identification code or retrieval data for the desired music; a display device 85 for visually displaying the words data and so forth... ...are added to renew the data base. The host computer 91 is connected to a public communication line 93 through the CPU 83 and teh **interface 92**.

In the operation procedure of the memory unit, as shown in Fig. 11, first the data code or the like is inputted (block 101) from... ...emitted as reproduced music from the loudspeaker 90. Meanwhile, if the data designated by the numerical value from the input unit 84 is not existent **in** the CD-ROM disc **81**, the result of teh decision becomes negative (no), so that the CPU 83 immediately **requests transmission** of the desired **music** data to the host computer 91 via the public communication line (block 104). And the music data transmitted (block 105) to the terminal apparatus is ...a CPU 152 for computing and processing the external data received. The CPU 152 processes both the instrumental music data and the words data simultaneously. **A** single CPU may be employed for common use as in this embodiment, or separate CPUs may be employed and **driven** synchronously with each other via a bus for individually processing the instrumental music data and the words data. Also shown are a first video memory...

Claims: ...1 or 2, further comprising: terminal-side control means (14) connected to the host computer (11) via a public communication line and serving to control **the** composite music data; a digital-to-analog (D/A) converter (15) for converting into an analog form the digital signal processed by said control means... ...according to claim 1 or 2, further including a plurality of memory means each comprising a main memory (24) for calculating and processing the composite **music** data of one musical piece or song, and an auxiliary memory (29) for previously storing a predetermined number of composite music data transmitted from the... ...memory means consists of an optical disc (81) for storing a multiplicity of music data, and there are further included a drive mechanism (82) for **driving** said optical disc, and a random access memory (RAM) for storing merely the selected music data.

8. An apparatus according to claim 7 and connected... ...in the stored content of the optical disc.

9. An apparatus according to claim 8, wherein the optical disc (81) is of an additionally writable **type**.

10. An apparatus according to claim 1 or 2, wherein said memory means comprises a semiconductor ROM (111) for storing a multiplicity of music data

Claims: ...n'existent pas dans le contenu memorise du disque optique.

9. Appareil selon la revendication 8, dans lequel le disque optique (81) est d'un **type** qui permet des ecritures supplementaires.

10. Appareil selon la revendication 1 ou 2, dans lequel le dispositif a memoires comporte une memoire morte a semi...

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15/3K/2 (Item 2 from file: 348)
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LABEL PRINTER
ETIKETTENDRUCKER
APPAREIL A IMPRIMER DES ETIQUETTES

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Specification: ...the disc. Background Art

Recently, recordable/reproducible disc systems have become commercially available one after another which store and reproduce main information stored therein and **attribute** information concerning the main information (which is formed of text data, and includes management information corresponding to the main information, a disc title entered by... ...cartridge 901 therein, and a case label 905 can be affixed thereto. The main label 903 to be affixed to the front face includes various **types** different in size, including the largest **type** having a size of approximately 36 mm x 52 mm, and the smallest **type** having a size of approximately 36 mm x 18 mm. The side label 904 has a size of approximately 4 mm x 60 mm. Further... ...as described above, and it is almost impossible to manually write lots of letters within a small-sized label. What is more, to make several **types** of labels has the problem that it demands much patience.

In view of the above circumstances, it is an object of the invention to provide... ...kinds of labels at a time.

disclosure of Invention

A label printer according to the invention as claimed in claim 1 is characterized by comprising **attribute** information request means that, to a control block of a disc playback system which reads main information stored in a disc in response to a main information readout request generated by external operating means, and reads **attribute** information concerning the main information in response to an **attribute** information readout request generated by said external operating means, the **attribute** information being formed of text data and stored in a predetermined area in the disc or a main unit of the system, makes the **attribute** information readout request in place of the external operating means or in combination with the external operating means; print means for printing on a label to be affixed to a disc cartridge accommodating the disc; and print control means for causing the **attribute** information read out in response to the **attribute** information readout request made by the **attribute** information request means to be converted to dot pattern data for print and causing the print means to print the dot pattern data. According to this construction of the label printer, to the control block of the disc playback system which reads **attribute** information in response to a **attribute** information readout request made by the external operating means, the **attribute** information request means makes an **attribute** information readout request in place of or in combination of the external operating means, and the **attribute** information read in response thereto is converted to dot pattern data and printed. In this case, the reading function which the disc playback system originally has is utilized, and therefore, without additionally providing a new function, the **attribute** information can be read from the disc. Further, since the read information can be printed on a label after the conversion, it is no longer... ...operating means includes a remote controller for externally operating the disc playback system, and the disc playback system includes remote control communication means for outputting **attribute** information in response to an **attribute** information readout request from the remote controller, to the remote controller, the **attribute** information request means transmitting the **attribute** information readout request via the remote control communication means, and the print control means converting the **attribute** information received via the remote control communication means to the dot pattern data. According to this construction of a preferred embodiment, the disc playback system has remote control communication means for outputting **attribute** information in response to the **attribute** information readout request made by the remote controller, and the system transmits the **attribute** information readout request via the remote control communication means and receives **attribute** information responsive thereto. That is, the printer makes use of the remote control communication means which the disc playback system originally has,

and hence without additionally providing a new reading capability, the **attribute** information can be read and printed on a label, whereby a label to be affixed to a disc cartridge can be made with ease, and... ...has means for communicating with the remote controller by wire, the remote control capability of the remote controller can be utilized to read out the **attribute** information to print it on the label. Therefore, the label can be easily made as a beautiful label.

Preferably, the remote control communication means includes... ...for a portable disc playback system.

Preferably, the remote controller is constructed in a manner such that the remote controller is capable of transmitting an **attribute** information readout request that requests display information, as the **attribute** information, which is to be displayed on a display block of the remote controller, and the **attribute** information request means is capable of transmitting an **attribute** information readout request that requests the same display information that is requested by the remote controller. According to this construction of a preferred embodiment, the remote controller is capable of outputting the **attribute** information readout request requesting the display information to be displayed on its own display block, and therefore, the remote control communication means, which is responsive to the request, is also capable of outputting the display information as the **attribute** information in response to the **attribute** information readout request. Since this label printer is capable of the same **attribute** information readout request as the remote controller requests, all the **attribute** information which can be displayed on the remote controller when the remote controller is connected to the system. In other words, it is possible to... ...According to this construction of a preferred embodiment, since the label printer is capable of communicating with the disc playback system by optical communication, the **attribute** information can be read by using this capability and printed onto a label, and hence the label can be easily made as a beautiful label... ...control means having the same capability of operating the disc playback system that the remote controller has, it is not only capable of reading the **attribute** information to thereby make a beautiful label with ease but also has the capability or function as the remote controller, which dispenses with the trouble... ...surface of the main unit accommodating the disc playback system, the disc playback system has a display block on which part or all of the **attribute** information read in response to the **attribute** information readout request from the disc-operating block as display information, and the **attribute** information request means has a printing operation button group arranged on the outer surface of the main unit of the system and is constructed in a manner such that the **attribute** information request means is used in combination with the disc- operating block to make the **attribute** information readout request requesting the display information, the **attribute** information request means being accommodated within the main unit of the system together with the print means, the print control means and the disc playback system. According to this construction of a preferred embodiment, an **attribute** information readout request requesting the display information is made by the **attribute** information request means which is used in combination with the disc-operating block of the external operating means of the disc playback system, and the display information as the **attribute** information read by the request is converted (by the print control means) to dot pattern data for printing and printed (by the print means). In... ...since a function is used which the disc playback system originally has for reading information to display the same on the display block, all the **attribute** information which can be displayed on the display block can be printed without additionally providing a new function. That is, it is possible to create... ...the label which has been conventionally created by manually writing therein the information displayed for confirmation on the remote controller. Further, in this case, the **attribute** information request means, the print means, and the print control means are received within a main unit of the disc playback system together with the system. Therefore, this preferred embodiment is suitable

for a **type** of the label printer which is incorporated within the main unit of a stationary disc playback system.

Preferably, the print control means is provided by... ...playback system, a new disc playback system incorporating the label printer can be made without much increasing the whole size of the system.

Preferably, the **attribute** information request means has print start-instructing means for instructing the start of processing of printing on the label, and makes the **attribute** information readout request after the start of printing is instructed. According to this construction of a preferred embodiment, the **attribute** information readout request is made only when the start of the printing is instructed, and therefore, it is possible to prevent wasteful printing operations from being carried out when the printing on a label is unnecessary.

Preferably, the disc playback system includes storage means for storing, as the **attribute** information, text data read from the disc or newly produced within the system as to the main information stored in the disc, and reads out the **attribute** information from the storage means in response to the **attribute** information readout request. According to this construction of a preferred embodiment, the disc playback system has storage means for storing the **attribute** information, and hence it is possible to read the **attribute** information instantly in response to an **attribute** information readout request. Therefore, in this case, the response to the **attribute** information readout request made by the **attribute** information request means of the label printer becomes also swift.

Preferably, the print control means converts the **attribute** information to a dot pattern for a printing tape formed with a half-die-cut label which is half-cut into a shape of a label. According to this construction, the **attribute** information is converted to a dot pattern for a printing tape having labels formed in a half-cut form (so-called half-die-cut form different from each other in the size of an outer shape. According to this construction of a preferred embodiment, the **attribute** information is converted to dot patterns for a printing tape formed with a plurality of kindsof labels different from each other in the size of... ...cartridge, and a side label to be affixed to a side surface of the disc cartridge. According to this construction of a preferred embodiment, the **attribute** information is converted to dot patterns for a printing tape formed with a plurality of **types** of half-die-cut label including a main label to be affixed to a front face of the disc cartridge, and a side label to... ...the print buffer for printing the side label. Therefore, the capacity of memory to be allocated to the print buffer can be minimized.

Preferably, the **attribute** information includes a disc title of the disc, main information numbers, and main information titles, and the print control means creates dot pattern data of... ...main label, and dot pattern data of the disc title at a location of the side label. According to this construction of a preferred embodiment, **details** of contents of the disc are printed on the main label having a larger area, and the disc title is printed on the side label. Therefore, the disks can be easily discriminated from each other e.g. when they are arranged side by side for storage.

Preferably, the **attribute** information includes a disc title of the disc, main information numbers and main information titles, the half-die-cut label for the printing tape includes a main label to be affixed to a front face of the disc cartridge, and the print control means creates dot pattern data of the **attribute** information at a location of the main label. According to this construction of a preferred embodiment, the **attribute** information is converted to a dot pattern for a printing tape formed with a half-die-cut

main label to be affixed to the front... ...only by printing the dot pattern, the main label can be easily made. Further, the main label can have a relatively large area, and hence **details** of contents of the disc, such as the disc title, the main information numbers and main information titles can be printed.

Preferably, the print control... ...the other lines (continuously on the following line, if a main information title is long). Therefore, the main label can be created in which the **details** of contents of the disc are printed out in a layout which enables the user to grasp the contents at a glance.

Preferably, the print...have the number of the remaining pieces of main information and a total number of pieces of main information recorded in the disc.

Preferably, the **attribute** information further includes play times respectively corresponding to the main information numbers and a date of each recording, the **attribute** information request means having print selection means for selecting and instructing a combination of pieces of **attribute** information to be requested by the **attribute** information readout request, the selecting instruction concerning the combination of pieces of **attribute** information which can be given by the printing selecting means including, in addition to a first selecting instruction in which a combination of the disc... ...selected for designation, and the print control means creates, as the dot pattern, dot pattern data of the selected and designated combination of pieces of **attribute** information out of the **attribute** information at the location of the main label. According to this construction of a preferred embodiment, in addition to the selecting instruction concerning the combination... ...label is obtained which generally gives all the necessary information concerning the main information.

Preferably, the selecting instruction concerning the combination of pieces of the **attribute** information further includes a second selecting instruction in which when all of the main information numbers and main information titles corresponding thereto cannot be printed... ...main information title, a play time, and a date of recording corresponding to the main information number are printed thereon side by side.

Preferably, the **attribute** information includes a disc title of the disc, the half-die-cut label of the printing tape including a side label to be affixed to... ...creates dot pattern data of the disc title at a location of the side label. According to this construction of a preferred embodiment, since the **attribute** information is converted to a dot pattern for a printing tape formed with a half-die-cut label for a side label to be affixed... ...side surface of the disc cartridge, the side label can be easily made by printing the dot pattern. Further, the disc title usually expresses the **features** of the disc, whereby the side label enables the disc to be discriminated from other labels.

Preferably, the half-die-cut printing tape includes a...side labels can be obtained which presents good appearances.

Preferably, pieces of the main information in the disc are numbered main information numbers, respectively, the **attribute** information including a disc title of the disc, the main information numbers and main information titles corresponding thereto, as well as a date of recording... ...the print control means creating dot pattern data of the disc title at a location of the side label as the dot pattern, when the **attribute** information read in response to the **attribute** information readout request by the **attribute** information request means contains the disc title, creating dot pattern data of the piece of the main information which has the smallest one of the main information numbers in place of the disc title, when

the read **attribute** information does not contain the disc title but contains the main information titles, and creating dot pattern data of the date of the recording, when the read **attribute** information does not contain the disc title nor the main information titles. According to this construction of a preferred embodiment, the **attribute** information is converted to a dot pattern for printing tape formed with a half-die-cut label for a side label to be affixed to ... ...of the disc, and the side label having the disc title printed thereon makes it easy to discriminate the disc from others. Further, when the **attribute** information does not contain the disc title but contains the main information titles, the dot pattern data of a main information title which is smallest... ...is printed. This makes it possible to make a side label which represents the contents of the disc to a most extent available from the **attribute** information.

Brief Description of Drawings

FIG. 1 is a diagram showing an appearance of a stationary MD record/playback system incorporating a label printer according... ...is a perspective view of a tape printing mechanism as a component block of the label printer according to the invention;

FIG. 3 is a **detailed** diagram of a printing tape formed with two **types** of half-die-cut labels;

FIG. 4 is a diagram showing an example of results of printing which is carried out on a main label...when the label printer is usedto combine request signals generated by operating a plurality of request keys on the remote controller and make series of **attribute** information requests;

FIG. 27 is a continuation of the FIG. 26 diagram;

FIG. 28 is a continuation of the FIG. 27 diagram;

FIG. 29 is... ...a block diagram showing the arrangement of the FIG. 30 system.

Best Mode of Carrying Out the Invention

The invention will now be described in **detail** with reference to drawings showing embodiments thereof. Further, a recordable/reproducible disc system of the invention will be described by using an MD system as... ...to be affixed to an MD cartridge (hereinafter, labels formed as such are referred to as "half-die-cut labels"). According to the label printer, **attribute** information is converted to a dot pattern for use with a printing tape 4 formed with labels defined by scored lines (formed by so-called... ...designates a print start button (print start means), which is operated to start a label-forming operation, as described hereinafter. In the label printer, an **attribute** information readout request, described hereinbelow, is made after instructing the start of a printing operation, which prevents execution of wasteful operations, such as printing processing... ...out only to print on a label when unnecessary.

Reference numeral 10 designates a slide print selection button (print selection means) for selecting combinations of **attribute** information items required to be printed on the main label 5. More **specifically**, by setting the slide print selection button 10 at a position designated by reference numeral 11 (first selecting instruction), it is possible to instruct the... ...the creation of a main label having "play time and recording date" printed thereon. In short, any of the above three kinds of combinations of **attribute** information items for printing can be selected by operating the slide print selection button 10.

Reference numeral 14 designates a record/playback operation button group...line at a pitch of 200 dots/inch in the direction of the width of the printing tape 4, a tape feed motor 25 for **driving** for rotation the platen roller 23 and the used ribbon-take-up roll for winding the used thermal transfer ink ribbon 22, and a cassette-detecting switch 26 for detecting the **type** or kind of printing tape-holding cassette 21. The cassette-detecting switch 26 determines whether or not there are holes formed in the printing tape... ...two detecting levers provided on the cassette-detecting switch 26 and detects the kind of printing tape-holding cassette 21, that is, the positions and **types** of shapes of the half-die-cut labels formed on the printing tape 4.

When labels are produced, a tape printing control system urges the... ...transfer ink ribbon 22 is transferred onto the printing tape 4 by a plurality of columns of dots to print characters.

FIG. 3 shows in **detail** a printing tape as an example of a combination of half-die-cut labels selected in respect of **type** and number from several **types** of half-die-cut labels having respective shapes are combined with each other. Reference numeral 4 designates a printing tape, reference numeral 5 a main... ...printing on the half-die-cut labels, and hence it is possible to easily produce labels one after another by changing printing tapes 4. More **specifically**, a printing tape 4 is accommodated in the printing tape-holding cassette (cassette) 21 and the printing tape 4 accommodated in the printing tape-holding... ...with ease.

Further, in the case of the label printer, the half-die-cut labels formed on the printing tape 4 include a plurality of **types** of half-die-cut labels different in outer shape and size from each other. As a result, by converting various kinds of **attribute** information, described hereinbelow, to a dot pattern for use with a printing tape 4 formed with a plurality of **types** of half-die- ...outer shape and size from each other, and printing the same on the printing tape 4, it is possible to easily create a plurality of **types** of labels different in outer shape and size from each other.

The above plurality of **types** of half-die-cut labels include a main label 5 (see the main label 903 appearing in FIG. 18) affixed to a top surface of... ...side labels (see the side labels 904 shown in FIG. 18) affixed to side surfaces of the MD cartridge (disc cartridge), so that by converting **attribute** information to a dot pattern for the printing tape 4 formed with the plurality of **types** of half-die-cut labels including the main label 5 and the side labels 6 or the like, and printing the same on the printing... ...printer is capable of creating the main label 5 as well as the three side labels 6, etc. simultaneously with ease.

In the label printer, **attribute** information required to be printed contains the disc title of an MD disc, a music number (main information number) as well as a music title (main information title), play time and a recording date corresponding to the music number. Further, **details** of the contents of a disc are printed on a main label 5 having a relatively large area, while a disc title and the like...recording the disc title may be printed side by side on the line after the disc title.

As described above, according to the label printer, **attribute** information is converted to a dot pattern for use with a printing tape 4, which is formed with half-die-cut labels thereon so as... ...to easily create a main label 5. Further, since the main label 5 can have a relatively large area, the same can be printed with **details** of the contents of a disc, such as a disc title, music numbers (main information numbers), music titles (main information titles), etc.

Further, the first... ...a continued manner), so that it is possible to produce a main label 5 with a print layout which enables the user to easily understand **details** of the contents of a disc.

Additionally, when it is impossible to print all the music numbers (main information numbers) and music titles (main information...side label 6 or the like) will be described.

FIG. 7 is an example of the side label 6 or the like printed with an **attribute** information item. Reference numeral 71 designates a disc title printed on the side label 6 or the like. In the present embodiment, the side label... ...recording date of music number 1 recorded in the MD is necessarily recorded for the above reason.

As described above, according to the label printer, **attribute** information is converted to a dot pattern for use with a printing tape 4, which is formed with half-die-cut labels thereon so as... ...possible to easily create a side label 6 or the like. In addition, the disc title of the MD disc provides a best representation of **features** of the MD (disc), so that a side label 6 or the like enables the user to easily distinguish discs from each other.

Further, when **attribute** information read out has not a disc title but music titles (main information titles), a dot pattern data of the music title corresponding to the... ...is created instead of the disc title and printing is carried out. If there are not contained any music titles (main information titles) in the **attribute** information read out, the recording date of a music piece having the smallest music number (smallest main information number: e.g. main information number 1) is printed. Hence, even when the **attribute** information read out does not include any music titles, it is possible to produce a side label 6 or the like which is best at... ...contents of a disc.

Furthermore, a dot pattern data is created in a manner such that the center of the dot pattern data length of **attribute** information (for instance, a disc title, the music title of a music piece having the smallest music number or the recording date of music number...First of all, the section relating to the recording and playback of MDs (disc playback system) will be described.

Reference numeral 81 designates an MD-**driving** block. During playback, the MD-**driving** block 8 reads out main information (music information data) and **attribute** information (management information data and text information data) comprised of text data (text cord data), both of which are digitally recorded on the MD, whereas... ...Reference numeral 82 designates a signal-processing block, which, during playback, temporarily stores management information data and text information data read out from the MD-**driving** block 81 and converts compressed digital music data into analog music signals for **driving** the loudspeakers 15 and 16. During recording, the signal-processing block 82 converts analog music signals sent from an external sound source 84 into compressed digital music data for transferring the digital music data and the management information data to the MD-**driving** block 81.

Reference numeral 85 designates a disc information storage block (storage means) comprised of the RAM, which stores data of a disc title, music... ...music piece, the total number of music pieces, the recording date of the disc title and the total play time of the disc, as information (**attribute** information) stored in a disc. The disc information is processed for storage by operating a system controller 86 (control block of the disc playback system, print control means, **attribute** information request means)

based on the management information data and text information data which is temporarily stored in the signal-processing block 82 when a playback process is started (in response to a main information readout request).

Among the above disc information (**attribute** information) items, data items of the disc title, music titles, the recording date of each music piece, and the recording date of the disc title... ...music selection button, a display switch button and a disc title display button for use in playback (for a main information readout request and an **attribute** information readout request) as well as a title button, a character selection button, a character-determining button and the like for use in entering text information.

Reference numeral 88 designates a display driver, which receives character codes (**attribute** information, display information) constituting each data item stored in the disc information storage block 85 and develops the same into a display dot pattern for... ...during selection of music numbers or during playback. Whenever the display switch button of the record/playback operation block 87 is operated (for making an **attribute** information readout request), a music title display block displays **attribute** information items of each music piece cyclically in the order of a music title, a play time and a recording date thereof.

Further, when the... ...is stored in the MD.

Next, the section relating to the label printer will be described hereinafter. Reference numeral 90 designates a printer-operating block (**attribute** information request means, printing operation button group), which includes the print start button (print start means) 9 and the print selection button (print selection means... ...print control program for controlling the tape printing mechanism, printing dot pattern data corresponding to character codes, information of shapes of labels corresponding to the **type** of a printing tape-holding cassette 21, and information of the position of the maximum printing area 32 (or 34), described above with reference to FIG. 3.

FIG. 9 is a diagram showing the arrangement of data items (**attribute** information) of music pieces serially stored in the disc information storage block 85. Reference numeral 101 designates the total number of music ...play time 2 of music number 2 and reference numeral 112 the recording date 2 of music number 2. As described above, various data items (**attribute** information, display information) of each of all music pieces displayed on the display 3 are serially stored in the disc information storage block 85.

During printing on labels, when the print start button (print start means) 9, which belongs to the printing operation button group of the printer-operating block (**attribute** information request means) 90, is operated, a label-forming process (see FIG. 10) is started. The system controller (the control block and print control means of the disc playback system) 86 reads out character codes (**attribute** information, display information) for the disc information storage block 85 according to the control program (for use in the label-forming process) of the tape... ...label 5, a side label 6 or the like).

As described above, according to the label printer of the present embodiment, the printer-operating block (**attribute** information request means) 90, which is used in combination with the record/playback operation block 87 as external operating means of the section relating to the recording and playback of MDs (disc playback system), makes an **attribute** information readout request for requesting display

information. Then, the display information as disc information (**attribute** information) read out in response to the request is converted into print dot pattern data by the system controller (print control means) 86, to thereby... ...of reading out information to be displayed on the display 3, is used, so that it is possible to print all the disc information items (**attribute** information) displayable on the display 3 without additionally providing a new capability. In other words, labels conventionally produced by confirming or viewing disc information displayed... ...and writing the same by hand can be created easily and beautifully by the label printer.

Further, in the above case, the printer-operating block (**attribute** information request means) 90, the printer block (print means) 91 and the system controller (print control means) 86 are arranged within a main unit of... ...apparatus.

In addition, in the present embodiment, since the disc playback system has a disc information storage block (storage means) 85 for storing disc information (**attribute** information), display information (**attribute** information) can be read out instantly in response to the operation (**attribute** information readout request) by the display switch button of the record/playback operation block (external operating means, disc-operating block) 87. Therefore, it is possible to respond more quickly to an **attribute** information readout request from the printer-operating block (**attribute** information request means) 90 in the label printer.

It should be noted that in the MD record/playback system 1, basically, a task interrupt (for making a main information readout request or an **attribute** information readout request) is generated to a main (control) program routine where the system controller 86 is in key entry wait state, by operating the... ...is started to carry out the interrupt handling operations.

Further, in each interrupt handling routine, each kind of control subroutine (hereinafter referred to as an "**attribute** information readout subroutine") for reading out character codes (**attribute** information, display information) from the disc information storage block (storage means) 85 in response to the main information readout request or the **attribute** information readout request is started to obtain **attribute** information items corresponding to the main information readout request or the **attribute** information readout request.

The **attribute** information readout subroutines in the embodiment can be realized by carrying out interrupt handling (sub)routines (or predefined function routines), such as a program for retrieving and reading out desired data (**attribute** information) stored in the disc information storage block 85 by using the title of the requested **attribute** information or a storage address thereof as a **parameter** (argument).

Now, the system controller 86 during execution of a main control program routine, during execution of the control program routine for recording and reproducing MDs, and during execution of the **attribute** information readout subroutines performs an original function that the system controller 86 has as a disc playback system, so that the system controller 86 in... ...entry wait state of the system controller 86, a task interrupt for carrying out the label-forming process is generated when the printer-operating block (**attribute** information request means) 90 is operated, whereby a print control program routine for carrying out an interrupt handling operation (label-forming process) relating to the ... ...a label printer, and hence it is described as print control means.

Further, the system controller 86 serving as print control means activates the above **attribute** information readout subroutines (steps 402 and 403 in FIG. 12, step 604 in FIG. 14, or steps 702, 708 and 711 in FIG. 15) in the print control program routine, described hereinbelow, so that the system controller 86 also has a capability of making an **attribute** information readout request, that is, performs a function of **attribute** information request means.

Therefore, according to the label printer in the MD record/playback system 1, when the print start button (print start means) 9, which belongs to the printing operation button group of the printer-operating block (**attribute** information request means) 90, is operated during printing on labels, the system controller 86 as the control block of the disc playback system starts a... ...to pass the control to the system controller 86 as the print control means.

The system controller 86 as the print control means activates the **attribute** information readout subroutines at a time point **attribute** information is required, according to the control program (print control program routine) stored in the ROM 93 and provided for executing the label-forming process... ...as the control block of the disc playback system.

The system controller 86 as the control block of the disc playback system carries out the **attribute** information readout subroutines to read out character codes (**attribute** information, display information) from the disc information storage block 85 and returns to the original print control program routine for passing the control to the... ...86 as the print control means.

The system controller 86 as the print control means repeats the same procedures as described above and obtains required **attribute** information to thereby carry out the label-forming process according to the print control program routine. Then, the system controller 86 stores print dot pattern... ...print control means may be separately implemented by respective controllers.

In such a case, it is preferred that storage means is provided which reads out **attribute** information required for forming a label from the disc information storage block (storage means) 85 at a time for storing the same, at time point the print start button (print start means) 9 of the printer-operating block (**attribute** information request means) 90 is operated to start the print control program routine, since in this case, it is possible to prevent frequent communication (interface... ...to avoid contention between the control block and the print control means for reading out the control programs.

Although in the above label printer, an **attribute** information readout request for requesting display information is made by the printer-operating block (**attribute** information request means) 90, which is used in combination with the record/playback operation block 87 as external operating means of the section relating to... ...is provided external operating means, such as a remote controller, the label printer can be configured such that the printer-operating block 90 makes an **attribute** information readout request in place of the remote controller (external operating means).

In any of the above cases, the label printer to which the invention is applied makes an **attribute** information readout request to the control block of the disc playback system having the capability of reading out **attribute** information in response to the **attribute** information readout request by the external operating means, in place of or in combination with external operating means, and converts the **attribute** information read out in response ...In any of the above cases, the readout capability which the

disc playback system originally has is employed, and hence it possible to read out **attribute** information without additionally providing a new function. Further, since the **attribute** information read out is converted into print dot pattern data for printing on a label, there is no need to write the **attribute** information by hand on a label. Therefore, according to the label printer, an attractive label for use in affixation to a disc cartridge can be... ...As a result, information of the shapes of half-die-cut labels and that of the position of the maximum printing area corresponding to the **type** of a printing tape-holding cassette 21, stored in the ROM 93 in advance, are determined (step 201).

Next, a print format-setting process shown in **detail** in FIG. 11 is executed. Here, the system controller 86 reads the state of the print selection button 10 (i.e. whether any of the first to third selecting instructions is designated), whereby a print dot pattern data-producing program corresponding to one of three **types** of print formats (see FIGS. 4, 5 and 6) for printing a main label 5 is selected (step 202).

Then, a print dot pattern data-producing process for printing a main label, shown in **detail** in FIGS. 12 to 14, is carried out, whereby the system controller 86 stores print dot pattern data (stored in the ROM 93) corresponding to... ...tape 4, followed by terminating the control program routine for the tape printing mechanism.

Next, the print format-setting process (step 202) is described in **detail** based on a flowchart showing a subroutine for carrying out the FIG. 11 print format-setting process.

Referring to FIG. 11, when the print format... ...music titles" (Yes), the program proceeds to a print dot pattern data-producing process-1 for forming a main label, which will be described in **detail** with reference FIG. 12 (step 303). On the other hand, if it is determined that the first selecting instruction for printing "disc title and music... ...to a step 305 for carrying out a print dot pattern data-producing process-2 for forming a main label, which will be described in **detail** with reference to FIG. 13. If "remaining music titles" is not to be printed (No), the program proceeds to a step 306 for carrying out a print dot pattern data-producing process-3 for forming a main label, which will be described in **detail** with reference to FIG. 14.

Now, the print dot pattern data-producing processes for forming a main label will be described in **detail** with reference to FIGS. 12 to 14 flowcharts.

FIG. 12 is a flowchart showing a subroutine for the print dot pattern data-producing process-1... ...the first line of the main label 5 (step 401).

Then, the system controller 86 sets the total number of music pieces as first data (**attribute** information) to be read from the disc information storage block 85 (for instance, by setting a label (title) of "total number of music pieces" or a pointer (storage address) designating the label to a **parameter**), and activates the **attribute** information readout subroutines (for retrieving the **attribute** information by using the **parameter**) (i.e. makes an **attribute** information readout request), whereby the system controller 86 obtains the total number of the music pieces (see FIG. 9: **attribute** information, display information) stored in the MD from the disc information storage block 85. In short, the system controller 86 sets the total number of music pieces as required **attribute** information, and makes an **attribute** information readout request to thereby read the total number of the music pieces (**attribute** information, display information) (step 402).

Thereafter, the system controller 86 (similarly makes an **attribute** information readout request and) reads in a character code (see FIGS. 4 to 5 and FIG. 9) of each character (hereinafter, a loop from the...to print a music number and a music title from the first column on the first line of the main label (step 501).

Next, although **detailed** description is omitted, the number of music pieces already printed is calculated according to substantially the same flowchart as the FIG. 12 flowchart showing the... ...started, the system controller 86 carries out initialization to set the play time and recording date of music number 1 (see FIGS. 6 and 9: **attribute** information, display information) as first data (**attribute** information) to be read from the disc information storage block 85 (step 601).

Then, to print the play time and the recording date on the... ...number and the music title corresponding to the set readout data (play time and recording date) is calculated according to approximately the same flowchart (whose **detailed** description is omitted now) as that showing the subroutine for carrying out the print dot pattern data-producing process-1 for forming a main label...program proceeding to a next process.

If not (No), the system controller 86 reads the play times and recording dates as the set readout data (**attribute** information) by making **attribute** information readout requests, similarly to the FIG. 13 subroutine (step 604).

Next, print dot pattern data stored in the ROM 93 and corresponding to data... ...the print buffer 94 (see FIGS. 3 and 6).

Next, a print dot pattern data-producing process for forming side labels will be described in **detail** with reference to a flowchart shown in FIG. 15.

When the print dot pattern data-producing process for forming side labels is started, as shown... ...main label, as initialization (step 701).

Then, the system controller 86 reads a disc title from the disc information storage block 85 (by making an **attribute** information readout request which sets a disc title as requested **attribute** information) (step 702).

Next, after carrying out a disc title-reading operation, it is determined whether or not there is a disc title (step 703... ...buffer 94.

If there is no disc title at the step 703 (No), music titles are read in increasing order of music numbers (according to **attribute** information readout requests in which music numbers and music titles are set as requested **attribute** information in increasing order of music numbers) (step 708).

Then, it is determined whether or not there is a music title read at the step... ...titles have not read (No), the program returns to the step 708 to read the music title of a next music number (according to an **attribute** information readout request).

If all the music titles have been read (Yes), the recording date of music number 1 is read in (according to an **attribute** information readout request in which the recording date of music number 1 is set as

requested **attribute** information) (step 711). Thereafter, the program returns to the step 704 and print dot pattern data corresponding to the recording date of music number 1...contents are printed on half-die-cut labels formed on a printing tape 4 but different in shape from each other, whereby a plurality of **types** of labels printed with suitable contents for affixing places can be produced at a time.

Next, a label printer according to a second embodiment of... ...system controller 937 and a printer controller 140, respectively.

Further, there is provided a print information storage block (storage means) 138 (85) for simultaneously reading **attribute** information required for forming a label from a disc information storage block (storage means) 936 (85) at a time for storage therein, to reduce the ... ...configured such that in a case where external operating means, such as a remote controller, is provided, the label printer is capable of making an **attribute** information readout request in place of the remote controller (provided as external operating means by remote control).

In the present embodiment, the label printer 121... ...above, whereby it is possible to use the portable MD recorder/player 911 as a disc playback system of which the label printer 121 requests **attribute** information.

First, description is made of the portable MD recorder/player 911 having a conventional construction.

FIGS. 30 and 31 are a perspective view of... ...the MD recorder/player 911 includes a system display 912 (3), a system-operating block 914 (87: external operating means, disc-operating block), an MD-**driving** block 932 (81), a signal-processing block 933 (82), a sound source 935 (84), a disc information storage block 936 (85: storage means), a system operating block 914. The remote controller display driver 926 receives character codes (**attribute** information, display information) constituting each data item stored in the disc information storage block 936 (85) and develops the same into a display dot pattern for displaying display characters on the remote controller display 922 comprised of a liquid crystal panel or the **like**.

The remote controller **display** 922 has a music number display area and a music title display area, similarly to the system display 912. Whenever the display switch button of the remote controller-operating block 923 is operated (for making an **attribute** information readout **request**), the **music** title display area displays **attribute** information items of each music piece cyclically in the order of a music title, a play time and a recording date.

The remote control controller... ...913 through the remote controller 921 to the earphones 924 to drive the same.

Next, operation of the remote controller 921 will be described in **detail**. When the music selection button of the remote controller-operating block 923 is operated (for making an **attribute** information readout request) to select a music number n, the remote control controller 927 reads out character codes (**attribute** information, display information) constituting data of a music number m of a music piece next to one reproduced from the disc information storage block 936... ...area of the remote controller display 922.

When the display switch button of the remote controller-operating block 923 is further operated (for making an **attribute** information readout request), the remote control controller 927 reads out character codes (**attribute** information, display information) constituting data of the music title n from the disc information-recording block 936 to store the same in the remote controller... ...state of the remote controller display 922, when the disc title display button of the remote controller-operating block 923 is operated (for making an **attribute** information readout request), the remote control controller 927 reads out character codes (see FIG. 9: **attribute** information, display information) constituting data of the total number of recorded music pieces and the disc title thereof from the disc information storage block 936...which is formed of the light-emitting diode 128. Reference numeral 134 designates a display driver, which is comprised of transistors and the like for **driving** the light-emitting diode 128.

Reference numeral 139 designates a ROM that stores, similarly to the ROM 93 in FIG. 8, a data read control... ...dot pattern data corresponding to character codes, information of shapes of labels and information of the position of the maximum printing area corresponding to the **type** of a printing tape-holding cassette 21.

Reference numeral 138 designates a print information storage block for storing data sent from the disc information storage... ...recordable/reproducible MD (disc), whereby it is possible to form a beautiful label to be affixed to an MD cartridge by a simple operation.

More **specifically**, when the print start button 9 is operated, the control program routine for controlling the tape printing mechanism, described above with reference to FIG. 10... ...side labels 6, etc., as described hereinbefore with reference to FIGS. 10 to 17.

However, in the present embodiment, the printer controller 140 sets all **attribute** information (see FIG. 9) required for forming labels, as requested **attribute** information according to the control program for controlling the tape printing mechanism, stored in the ROM 139. This setting is carried out at the steps 401, 501 and 601 for initialization, described above with reference to FIGS. 12 to 14, respectively. Then, the printer controller 140 makes an **attribute** information readout request and reads out the **attribute** information from the disc information storage block (storage means) 936 (85) via the remote controller-connecting block 913 at a time, to store the same in the print information storage block (storage means) 138 (85).

Therefore, although in the first embodiment, other processes are carried out according to the **attribute** information readout subroutines (for making **attribute** information readout requests) (402 and 403 in FIG. 12, 604 in FIG. 14, and 702, 708 and 711 in FIG. 15), in this embodiment, they... ...executed simply as a readout process for reading out data from the print information storage block 138.

As described above, the label printer 121 requests **attribute** information of the portable MD recorder/player 911 as the disc playback system, and has the remote controller-connecting block (remote control communication means) 913 for outputting **attribute** information responsive to an **attribute** information readout request from the remote controller 921. Therefore, the label printer 121 sends an **attribute** information readout request and receives **attribute** information responsive to the request, via the remote controller-connecting block (remote control communication means) 913.

That is, since the label printer uses the remote controller-connecting block (remote control communication means) 913 originally incorporated in the MD recorder/player (disc playback system) 911, **attribute** information can be read out for printing on labels without additionally providing a new readout function, and it is possible to form beautiful labels for...in remote control which is removably connected to the remote controller 921. Therefore, simply by connecting the printer connection cable 128 to the connector terminal, **attribute** information can be read out by making use of the function of the remote controller 921 to printing on labels, whereby it is possible to form beautiful labels, and what is more, by a simple operation.

In short, the label printer 121 is suitable for requesting **attribute** information of a portable disc playback system, for instance.

Further, in the above embodiment, the remote controller 921 is capable of making or outputting an **attribute** information readout request for requesting display information to be displayed on the remote controller display 922 thereof, so that the remote controller-connecting block (remote control communication means) 913, which is capable of responding to the request, can also output display information as **attribute** information to the remote controller 921 in response to the **attribute** information readout request.

Since the label printer 121 is capable of sending the same **attribute** information readout request as that sent by the remote controller 921, it is possible to print all **attribute** information which can be displayed on the remote controller display 922 of the remote controller 921, when the label printer 12 is connected to the... ...the printing being reliably carried out.

Although in the description made with reference to FIGS. 10 to 17, it is assumed that various data items (**attribute** information) of music pieces are stored in the disc information storage block 85 (corresponding to the disc information storage block 936 of the present embodiment... ...FIG. 9, i.e. the music number m = 1 is set, and at the same time a separator code 100 is added to show (store) **attribute** information of music pieces, the **attribute** information is presented as shown in FIG. 21. In this case, the arrangement of **attribute** information is the same as that shown in FIG. 9, and data is processed substantially in the same manner as processed by the FIG. 9... ...enables labels to be easily formed by processing similar to the subroutines shown in FIGS. 10 to 17.

Further, although in the above description, the **attribute** information readout subroutines (for making an **attribute** information readout request) are not activated separately at the respective corresponding steps (402 and 403 in FIG. 12, 604 in FIG. 14, 702, 708 and... ...completion of the printing.

In the following, for precautionary purposes, a print control program routine for controlling a label-forming process including the above mentioned **details** of processing will be described with reference to a flowchart shown in FIG. 22.

When the print start button 9 is operated, the power of... ...138, and setting of addresses for storing initial data items is carried out (step 212).

Then, a data-reading process is started, and display information (**attribute** information) of an MD stored in the ... the MD recorder/player 911 is read out for storing the same in the print information storage block 138 (step 213).

In other words, all **attribute** information required for forming labels (see FIG. 9 or FIG. 21) is set as requested **attribute** information, and an **attribute** information readout request is made for reading out the **attribute** information from the disc information storage block 936 via the remote controller-connecting block 913 at a time. The **attribute** information read out is stored in the print information storage block 138.

Next, the print format-setting process (step 202) to the print control process... ...at (step 210).

In the above description, it assumed that in the initialization (step 401) or the like and the disc-reading process (step 213), **attribute** information is read out from the disc information storage block 936 of the MD recorder/player 911 at a time, by using an **attribute** information readout request. However, it is also possible to assume such a case where **attribute** information can not be read out at a time. e.g. for the following reasons: data items (pieces of **attribute** information) stored in the disc information storage block 936 are not configured or formed (in order of arrangement or in data format) as shown in... ...an example of a data-reading process will be described with reference to a flowchart shown in FIG. 23, in which data items (pieces of **attribute** information) are separately read out (by making respective **attribute** information readout requests), formed (in order of arrangement or in data format) as shown in FIG. 9 or FIG. 21, and stored in the print... ...generated when the disc title display button of the remote controller is operated, and sends the signal to the system controller 937 (for making an **attribute** information readout request) via the remote controller-connecting block 913 (step 1001).

As a result, the system controller 937 sends character codes (see FIG. 21, for instance: **attribute** information, display information) representative of the total number of music pieces and a disc title stored in the disc information storage block 936 to the printer controller 140, so that the printer controller 140 stores the information (**attribute** information, display information) at predetermined addresses within the print information storage block 138 (step 1002).

Further, separator codes 100 are additionally provided after the total... ...that generated when the display switch button of the remote controller is operated, and sends the signal to the system controller 937 (for making an **attribute** information readout request) (step 1005).

As a result, the system controller 937 sends character codes (**attribute** information, display information) representative of the total play time stored in the disc information storage block 936 to the printer controller 140, and hence, the... ...that generated when the music selection button of the remote controller is operated, and sends the signal to the system controller 937 (for making an **attribute** information readout request) via the remote controller-connecting block 913 (step 1009).

As a result, the system controller 937 sends character codes (**attribute** information, display information) representative of the music number m (e.g. music number 1: m = 1) of a music piece next to one which is...that generated when the display switch button of the remote controller is operated, and sends the signal to the system controller 937 (for making an **attribute** information readout request) (step 1013).

As a result, the system controller 937 sends character codes (**attribute** information, display information) representative of the play time m of the music number m stored in the disc information storage block 936 to the printer... ...MD recorder/player 911 by operating the remote controller.

For instance, as shown in FIG. 24, when the user operates a key for requesting desired **attribute** information (hereinafter, operating this key is provisionally described as depressing the "request key"), a request process (Q10) as an interrupt handling routine is activated and ... ...example, for instance, when the user depresses the disc title display button (disc title request key), the above process is carried out, and character codes (**attribute** information, display information) representative of the total number of music pieces and a disc title are sent as a first response data RP1 and a...can effect the same function as that of the remote controller 921.

Further, the invention can be applied to an MD recorder/player different in **specification** from the MD recorder/player 911 employed in the above example. Furthermore, it is also possible to generate request signals by operating a plurality of request keys thereof and combine the request signals for successively requesting **attribute** information. This holds true with the FIG. 10 overall control process, the FIG. 22 overall control process, and the FIG. 23 overall control process correspond to this case. An example in which **attribute** information is successively requested of an MD player remotely controllable but different in **specification** will be described hereinafter as a fourth embodiment of the invention and so forth.

Furthermore, although the description has been made based on an example... ...title display button. Reference numeral 145 designates a remote controller display block formed of a liquid crystal panel. The remote controller display block 145 is **driven** by a remote controller display driver 146.

Reference numeral 147 designates an infrared transmitter/receiver for inputting and outputting signals to and from the infrared... ...the label printer 141 is constructed as above, the conventional stationary MD recorder/player 951 can be used as a disc playback system of which **attribute** information is requested, and moreover, it is possible to form labels to be affixed to an MD cartridge as beautiful labels, and what is more... ...the function of sending/receiving data to/from the disc playback system by optical communication, it is possible to use the function for reading out **attribute** information and printing the same on labels, thereby enabling beautiful labels to be formed by a simple operation. Further, the label printer 141 is provided... ...disc playback system, which dispenses with the trouble of having and operating a remote controller separately provided. That is, the printer is suitable for requesting **attribute** information of a stationary disc playback system, for instance.

Although in the above description of the first to third embodiments, a system capable of recording and reproducing data on MDs was used as a disc playback system of which the label printer of the invention requests **attribute** information, this is not limitative, but a system exclusively provided for playback may be employed.

Further, for ...request button) is depressed, the total number of music pieces and a disc title are read out, and when the display switch button is depressed, **attribute** information is displayed in a manner switched as follows: music title --> playing (playback) time period --> recording date --> music title. Further, when the music selection button... ...m) of a music piece next to one reproduced the last time. However, the invention can be applied to a disc playback system different in **specification** from these.

Therefore, in the following, a fourth embodiment of the invention will be described, which can successively request **attribute** information of an MD player remotely controllable but different in **specification**.

The MD player contemplated in the fourth embodiment has a capability operable from a remotely located keyboard and uses kinds of (request) keys different from... ...the third embodiment.

Now, the MD player according to the present embodiment is a kind of MD player commercially available, which has, as the above **types** of request keys, a play key (PLAY key), a rewind key (music piece reinstall key) (REWIND key: hereinafter simply referred to as "the REW key... ...in this MD player stores information of one music piece per one track with each track number and a music number in agreement with each **other**. The **PLAY** key has the function of playing back MDs and further, if it continues to be depressed for a predetermined time period, it can activate the... ...a request signal). When playback is requested, the MD player starts a playback process in response thereto and sends the number and title of a **requested music** piece to the remote controller during playback, whereas when fast forward is requested, the MD player sequentially outputs a track number (music number) and a... ...by fast forward without waiting for each information to be reproduced as music information.

The REW key is a request key for requesting character data (**attribute** information: character data of the track number (music number) and music title) of a music piece being reproduced, or alternatively character data of a music the remote controller and combine the request signals to successively request **attribute** information of the MD player. More **specifically** , a processing program is changed by operating a newly provided key or an existing one, whereby it is also possible to make a desired combination of requests for **attribute** information. For instance, it is also possible to provide a request key, such as a "read key", to request music titles of an arbitrary number... ...RQ21 is received, the display mode of the MD player is changed so as to respond to a request included therein (P201), and character data (**attribute** information, display information) corresponding to the display mode is sent as response data RP21 (P202).

When the response data RP21 as character data is received... ...character data is not a desired disc title display data (character data of the total number of music pieces + a disc title) (No to Q203), **attribute** information is requested again (Q201). Further, as described above, in the above cases as well, the identification data arranged at the head of the response... ...player, a playback track number (i.e. a music number) is incremented by 1 as response processing responsive to the request (P212), and character data (**attribute** information, display information) of the track number (the music number) is sent as a first response data RP2C1 (P213), followed by sending character data of...Now, since the number of remaining music pieces j = 1 holds (Yes to Q217), all processes are terminated (Q219).

At this time point, character data (**attribute** information, display information) desired to be obtained, of the disc title (the total number of music pieces + the disc title) and the music titles (the...button 9 used in the first to third embodiments is external operating means which activates the FIG. 10 process to make a plurality of successive **attribute** information readout requests, so that the print start button 9 corresponds to (a key having the enhanced function of) the read (request) key.

Although in... ...applied to other disc systems as well, so long as they are capable of reading out main information stored in a recordable/reproducible disc and **attributeinformation** (management information, text information and the like) corresponding thereto.

Industrial Applicability

As described above, the label printer according to the invention is suitable for printing...

Claims:

1. A label printer comprising:

attribute information request means that, to a control block of a disc playback system which reads main information stored in a disc in response to a main information readout request generated by external operating means, and reads **attribute** information concerning said main information in response to an **attribute** information readout request generated by said external operating means, said **attribute** information being formed of text data and stored in a predetermined area in said disc or a main unit of said system, makes said **attribute** information readout request in place of said external operating means or in combination with said external operating means;

print means for printing on a label to be affixed to a disc cartridge accommodating said disc; and

print control means for causing said **attribute** information read out in response to said **attribute** information readout request made by said **attribute** information request means to be converted to dot pattern data for print and causing said print means to print said dot pattern data.

2. A... ...operating means includes a remote controller for externally operating said disc playback system,

wherein said disc playback system includes remote control communication means for outputting **attribute** information in response to an **attribute** information readout request from said remote controller, to said remote controller,

wherein said **attribute** information request means transmits said **attribute** information readout request via said remote control communication means; and

wherein said print control means converts said **attribute** information received via said remote control communication means to said dot pattern data.

3. A label printer according to claim 2, wherein said remote control... ...label printer according to claim 2, wherein said remote controller is constructed in a manner such that said remote controller is capable of transmitting an **attribute** information readout request that requests display information, as said **attribute** information, which is to be displayed on a display block of said remote controller; and

wherein said **attribute** information request means is capable of transmitting an **attribute** information readout request that requests the same display information that is requested by said remote controller.

6. A label printer according to claim 2, wherein... ...of said main unit accommodating said disc playback system,

wherein said disc playback system has a display block on which part or all of said **attribute** information read in response to said **attribute** information readout request from said disc-operating block as display information, and

wherein said **attribute** information request means has a printing operation button group arranged on said outer surface of said main unit of said system and is constructed in a manner such that said **attribute** information request means is used in combination with said disc-operating block to make said **attribute** information readout request requesting said display information, said **attribute** information request means being accommodated within said main unit of said system together with said print means, said print control means and said disc playback... ...functions of said control block of said disc playback system.

10. A label printer according to any one of claims 1 to 9, wherein said **attribute** information request means has print start-instructing means for instructing the start of processing of printing on said label, and makes said **attribute** information readout request after the start of printing is instructed.

11. A label printer according to any one of claims 1 to 9, wherein said disc playback system includes storage means for storing, as said **attribute** information, text data read from said disc or newly produced within said system as to said main information stored in said disc, and reads out said **attribute** information from said storage means in response to said **attribute** information readout request.

12. A label printer according to any one of claims 1 to 9, wherein said print control means converts said **attribute** information to a dot pattern for a printing tape formed with a half-die-cut label which is half-cut into a shape of a... ...which are different from each other in the size of an outer shape.

17. A label printer according to claim 16, wherein said plurality of **types** of half-die-cut label include a main label to be affixed ...data for said side label in said print buffer when said side label is printed.

20. A label printer according to claim 17, wherein said **attribute** information includes a disc title of said disc, main information numbers, and main information titles, and

wherein said print control means creates dot pattern data... ...and dot pattern data of said disc title at a location of said side label.

21. A label printer according to claim 12, wherein said **attribute** information includes a disc title of said disc, main information numbers and main information titles,

wherein said half-die-cut label for said printing tape... ...main label to be affixed to a front face of said disc cartridge, and

wherein said print control means creates dot pattern data of said **attribute** information at a location of said main label.

22. A label printer according to claim 21, wherein said print control means creates dot pattern data... ...includes the remaining number of pieces of said main information which remain to be printed.

26. A label printer according to claim 25, wherein said **attribute** information further includes play times respectively corresponding to said main information numbers and a date of each recording,

wherein said **attribute** information request means has print selection means for selecting and instructing a combination of pieces of **attribute** information to be requested by said **attribute** information readout request,

wherein the selecting instruction concerning said combination of pieces of **attribute** information which can be given by said printing selecting means includes, in addition to a first selecting instruction in which a combination of said disc... ...for designation, and

wherein said print control means creates, as said dot pattern, dot pattern data of the selected and designated combination of pieces of **attribute** information out of said **attribute** information at said location of said main label.

27. A label printer according to claim 26, wherein the selecting instruction concerning said combination of pieces of said **attribute** information further includes a second selecting instruction in which when all of said main information numbers and main information titles corresponding thereto cannot be printed... ...selecting instruction being selected for designation, when said third selecting instruction is selected for designation.

29. A label printer according to claim 12, wherein said **attribute** information includes a disc title of said disc,

wherein said half-die-cut label of said printing tape includes a side label to be affixed...33. A label printer according to claim 12, wherein pieces of said main information in said disc are numbered main information numbers, respectively,

wherein said **attribute** information includes a disc title of said disc, said main information numbers and main information titles corresponding thereto, as well as a date of recording... ...said print control means creates dot pattern data of said disc title at a location of said side label as said dot pattern, when said **attribute** information read in response to said **attribute** information readout request by said **attribute** information request means contains said disc title,

creates dot pattern data of said piece of said main information which has said smallest one of said main information numbers in place of said disc title, when said read **attribute** information does not contain said disc title but contains said main information titles, and

creates dot pattern data of said date of said recording, when said read **attribute** information does not contain said disc title nor said main information titles.

Dialog eLink: Order File History

DIALOG(R)File 348: EUROPEAN PATENTS
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15/3K/3 (Item 3 from file: 348)
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Musical performance teaching system and method, and machine readable medium containing program therefore
Methode und System um das Spielen eines Musikinstrumentes zu unterrichten sowie maschinenlesbares Speichermedium fur ein entsprechendes Unterrichtsprogramm
Methode et systeme pour apprendre a jouer d'un instrument de musique ainsi que support de donnees dechiffrable machinellement incorporant un programme approprie

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B. Full-Text Databases – NON-PATENT

File 20:Dialog Global Reporter 1997-2010/Jun 04
(c) 2010 Dialog
File 477:Irish Times 1999-2010/Jun 04
(c) 2010 Irish Times
File 710:Times/Sun.Times(London) Jun 1988-2010/Jun 04
(c) 2010 Times Newspapers
File 711:Independent(London) Sep 1988-2006/Dec 12
(c) 2006 Newspaper Publ. PLC
File 756:Daily/Sunday Telegraph 2000-2010/Jun 04
(c) 2010 Telegraph Group
File 757:Mirror Publications/Independent Newspapers 2000-2010/Jun 04
(c) 2010

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Set     Items   Description
S1      23284   (MUSIC? OR MELODY OR SONG OR SONGS OR SINGING OR
PERFORMANCE(5N)(MUSIC?
 OR BAND OR ORCHESTR?) OR ORCHESTRA? OR BANDS)(4N)(SEARCH? OR QUER? OR REQUEST? OR
 INQUIR? OR USER(2N)INPUT?)

S2      13723   (INTERFACE? OR SCREEN? ? OR MONITOR? ? OR COMPUTER? OR NETWORK ? OR
WEB?  OR ONLINE OR DATABASE? OR DATASYSTEM? OR PROCESSOR? OR ENGINE? ? OR GUI OR
DISPLAY? OR  CRT? ? OR CATHODE()RAY OR OUTPUT? OR WORKSTATION? OR KEYBOARD? OR PC
OR (KNOWLEDGE OR  DATA)()BASE?  )

S3   31099604   ATTRIBUTE? OR FEATURE? OR QUALIT? OR CHARACTERISTIC? OR PARAMET? OR
TERMS OR NATURE OR VECTOR? OR SPEC? OR DETAIL?

S4   18583227   GENRE? OR TYPE? OR ROCK OR R(2W)B OR BLUES OR RHYTHM(2W)BLUES OR
STYLE?  OR CLASSICAL OR MODERN OR PROG OR PROGRESSIVE OR METAL OR HEAVY OR
INSTRUMENTALS OR  POPULAR OR ALTERNATIVE(2W)(MUSIC? OR ROCK) OR INDY OR INDIE OR
DRIVEN OR POP OR  CLASSIFICATION? OR TAXONOM? OR TYPOLOGY

S5   10154387   EMOTION? OR MOOD? OR HAPPY OR SAD OR DARK OR RHYTHM(2N)TYPE OR
INTENSE OR LOUD OR MELLOW OR RAUCOUS OR SAD OR AGGRESSIVE OR UPBEAT OR DOWNCAST OR
ROWD? OR  ROMANTIC OR SWEET OR DRIVING OR DANCEABLE

S6       5196   (SELECTION? OR EXAMPLE? OR PROMOTIONAL OR SUGGESTION? OR SIMILAR OR
 ALTERNAT? OR RELATED OR OTHER OR SUPPLEMENT? OR LIKE OR COMMON OR SELECT) (3N)
(OFFER? OR PRESENT? OR SUGGEST? OR DISPLAY? OR GUI ? ? OR BRING?()UP OR INTERFACE?
OR SPEAKER? ?  OR HEADPHONE? OR HEAD()PHONE? OR EAR()PHONE? OR EARPHONE? OR PLAY?)
OR SAMPLE? OR SONGSELECTION? OR EXCERPT?

S7       3000   S3 AND S4 AND S5
S8       1293   S6(S)S1
S9        380   S8 AND S7
S10       258   S9 FROM 348,349
S11        57   S10 NOT AY>2000
S12        30   S11 AND SAMPLE?
S13        27   S11 NOT S12
```

```
S14         10   S13 NOT PY>2000
S15         10   RD  (unique items)
S16         30   IDPAT S12 (sorted in duplicate/non-duplicate order)
S17         30   IDPAT S12 (primary/non-duplicate records only)
S18        122   S9 NOT S10
S19         26   S18 NOT PY>2000
```
S20 26 RD (unique items)

File 387:The Denver Post 1994-2010/Jun 03
(c) 2010 Denver Post
File 471:New York Times Fulltext 1980-2010/Jun 04
(c) 2010 The New York Times
File 492:Arizona Repub/Phoenix Gaz 19862002/Jan 06
(c) 2002 Phoenix Newspapers
File 494:St LouisPost-Dispatch 1988-2010/May 30
(c) 2010 St Louis Post-Dispatch
File 631:Boston Globe 1980-2009/Dec 30
(c) 2010 Boston Globe
File 633:Phil.Inquirer 1983-2010/Jun 04
(c) 2010 Philadelphia Newspapers Inc
File 638:Newsday/New York Newsday 1987-2010/Jun 04
(c) 2010 Newsday Inc.
File 640:San Francisco Chronicle 1988-2010/Jun 04
(c) 2010 Chronicle Publ. Co.
File 641:Rocky Mountain News Jun 1989-2009/Jan 16
(c) 2009 Scripps Howard News
File 702:Miami Herald 1983-2010/Jun 04
(c) 2010 The Miami Herald Publishing Co.
File 703:USA Today 1989-2010/Jun 04
(c) 2010 USA Today
File 704:(Portland)The Oregonian 1989-2010/Jun 03
(c) 2010 The Oregonian
File 713:Atlanta J/Const. 1989-2010/Jun 04
(c) 2010 Atlanta Newspapers
File 714:(Baltimore) The Sun 1990-2010/Jun 04
(c) 2010 Baltimore Sun
File 715:Christian Sci.Mon. 1989-2009/Dec 07
(c) 2009 Christian Science Monitor
File 725:(Cleveland)Plain Dealer Aug 1991-2010/Jun 03
(c) 2010 The Plain Dealer
File 735:St. Petersburg Times 1989- 2010/May 05
(c) 2010 St. Petersburg Times
File 635:Business Dateline(R) 1985-2010/Jun 04
(c) 2010 ProQuest Info&Learning
File 570:Gale Group MARS(R) 1984-2010/Apr 30
(c) 2010 Gale/Cengage
File 47:Gale Group Magazine DB(TM) 1959-2010/May 12

(c) 2010 Gale/Cengage
File 15:ABI/Inform(R) 1971-2010/Jun 03
(c) 2010 ProQuest Info&Learning
File 9:Business & Industry(R) Jul/1994-2010/Jun 03
(c) 2010 Gale/Cengage
File 610:Business Wire 1999-2010/Jun 04
(c) 2010 Business Wire.
File 810:Business Wire 1986-1999/Feb 28
(c) 1999 Business Wire
File 275:Gale Group Computer DB(TM) 1983-2010/Apr 26
(c) 2010 Gale/Cengage
File 624:McGraw-Hill Publications 1985-2010/Jun 04
(c) 2010 McGraw-Hill Co. Inc
File 621:Gale Group New Prod.Annou.(R) 1985-2010/Apr 15
(c) 2010 Gale/Cengage
File 636:Gale Group Newsletter DB(TM) 1987-2010/Jun 04
(c) 2010 Gale/Cengage
File 613:PR Newswire 1999-2010/Jun 04
File 813:PR Newswire 1987-1999/Apr 30
(c) 1999 PR Newswire Association Inc
File 16:Gale Group PROMT(R) 1990-2010/Jun 04
(c) 2010 Gale/Cengage
File 160:Gale Group PROMT(R) 1972-1989
(c) 1999 The Gale Group
File 634:San Jose Mercury Jun 1985-2010/Jun 03
(c) 2010 San Jose Mercury News
File 148:Gale Group Trade & Industry DB 1976-2010/Jun 04
(c) 2010 Gale/Cengage

```
Set     Items   Description
S1      36717   (MUSIC? OR MELODY OR SONG OR SONGS OR SINGING OR
PERFORMANCE(5N)(MUSIC? OR BAND OR ORCHESTR?) OR ORCHESTRA? OR BANDS)(4N)(SEARCH? OR
QUER? OR REQUEST? OR  INQUIR? OR USER(2N)INPUT?)

S2   40936270   ATTRIBUTE? OR FEATURE? OR QUALIT? OR CHARACTERISTIC? OR PARAMET? OR
TERMS  OR NATURE OR VECTOR? OR SPEC? OR DETAIL?

S3   39635470   GENRE? OR TYPE? OR ROCK OR R(2W)B OR BLUES OR RHYTHM(2W)BLUES OR
STYLE? OR CLASSICAL OR MODERN OR PROG OR PROGRESSIVE OR METAL OR HEAVY OR
INSTRUMENTALS OR  POPULAR OR ALTERNATIVE(2W)(MUSIC? OR ROCK) OR INDY OR INDIE OR
DRIVEN OR POP OR CLASSIFICATION? OR TAXONOM? OR TYPOLOGY

S4      10890   EMOTION? OR MOOD? OR HAPPY OR SAD OR DARK OR RHYTHM(2N)TYPE OR
INTENSE OR LOUD OR MELLOW OR RAUCOUS OR SAD OR AGGRESSIVE OR UPBEAT OR DOWNCAST OR
ROWD? OR  ROMANTIC OR SWEET OR DRIVING OR DANCEABLE

S5       8554   (SELECTION? OR EXAMPLE? OR PROMOTIONAL OR SUGGESTION? OR SIMILAR OR
 ALTERNAT? OR RELATED OR OTHER OR SUPPLEMENT? OR LIKE OR COMMON OR SELECT) (3N)
(OFFER? OR PRESENT? OR SUGGEST? OR DISPLAY? OR GUI ? ? OR BRING?()UP OR INTERFACE?
OR SPEAKER? ?
```

```
 OR HEADPHONE? OR HEAD()PHONE? OR EAR()PHONE? OR EARPHONE? OR PLAY?) OR SAMPLE? OR
 SONGSELECTION? OR EXCERPT?

S6         779   S2(S)S3(S)S4
S7        2208   S1(S)S5
S8          71   S7(S)S6
S9          30   S8 NOT PY>2000
S10         18   RD  (unique items)
```

10/3,K/18 (Item 1 from file: 813)
DIALOG(R)File 813: PR Newswire
(c) 1999 PR Newswire Association Inc. All rights reserved.

1216068 NYF087
EMI Music Publishing Launches Advanced Online Lyric Catalogue

Date: January 23, 1998 11:46 EST **Word Count:** 584

Correction:
...to, and soundclips from, thousands of songs from EMI's rich and varied collection of songs.

The lyric catalogue is completely user-friendly. Researchers simply **type** the word(s) that best describe the **mood** or idea they are looking for. Next, the search engine reads all the lyrics of every song in EMI's vast online database. At the end of each list of matching **songs**, the **search** will also offer additional synonyms from its internal thesaurus that **offers** an even greater **selection** of descriptive **terms** for searching.

The lyric search engine, which is part of the overall EMI site designed and created by Gary Klein, Senior Vice President Creative Services...

20/3,K/7 (Item 7 from file: 20)
DIALOG(R)File 20: Dialog Global Reporter
(c) 2010 Dialog. All rights reserved.

11889666 **(USE FORMAT 7 OR 9 FOR FULLTEXT)**
Hitting the Right Notes

Music-recommendation sites figure out what kind of tunes you like, then suggest artists - both famous and obscure - that match your taste

Section Title: Technology

Compiler: Brad Stone
NEWSWEEK INTERNATIONAL
July 10, 2000
Journal Code: FNWI **Language:** English **Record Type:** FULLTEXT
Word Count: 885
(USE FORMAT 7 OR 9 FOR FULLTEXT)

...you goose bumps," says CEO John Adams, so he's hired two dozen music experts to evaluate songs and put them into subcategories within their **genre**, like "Rap **Metal**" and "HipHop Jazz" within rap, for instance. On the site, you pick among a graphical universe of 54 musical **types** such as **rock** or jazz, and weird **mood** categories like "evil" and "go girl!" Then you're asked to rate seven brief music clips. I went for the "stoned" category and took the...

...hadn't heard of, including Ian Brown and Tim Bluhm. Unfortunately, copyright law limits the clips to 30 seconds, which wasn't enough of a **sample** to judge whether I wanted to buy their CDs.

MoodLogic.com presents an interesting twist on the same idea, with CEO Tom Sulzer arguing that "music is **emotion**." Sulzer organized a thousand music lovers to rate the **mood** of various songs, and now visitors to the site are asked to respond in 10 categories about the **mood** of tunes they want to hear; in one search, I **specified** a "**happy**" song from the '70s, with a "very fast" tempo and a "light" beat. But I didn't bother to **specify** a **genre**, and the site came back with a 30-second clip from John Denver's "Grandma's Feather Bed." No thanks.

The other players in the...

...a more technology-centric approach. CantaMetrix, MongoMusic and Gigabeat all use varying forms of "digital signal analysis," which takes a song you like and evaluates **characteristics** such as beats per minute, then groups it with statistically similar tunes. Gigabeat is the farthest along in this approach. You can plug in any...

...re available to download - though I found many of the links to be broken.

One of the most promising approaches to music recommendations involves community-**driven** ratings. The idea here is closely related to collaborative filtering, a technology prominently used at Amazon.com to suggest products bought by folks whose buying...

...three-hour period, and it can't show you your playlist.

Overall, online music recommendations have a ways to go. But the technology is inspiring **heavy** buzz at gatherings like the MP3 Summit, held last week in San Diego. **Popular** sites like Napster and MP3.com, the thinking goes, are great for college kids who know what they want, but music sites will capture a...

20/3,K/2 (Item 2 from file: 20)
DIALOG(R)File 20: Dialog Global Reporter
(c) 2010 Dialog. All rights reserved.

13334794 **(USE FORMAT 7 OR 9 FOR FULLTEXT)**
imix.com Signs Agreement with Yahoo! Shopping to Provide Customized Entertainment to Millions of Shoppers

BUSINESS WIRE
October 17, 2000
Journal Code: WBWE **Language:** English **Record Type:** FULLTEXT
Word Count: 950
(USE FORMAT 7 OR 9 FOR FULLTEXT)

...resource of online personalized entertainment, today announced an agreement with Yahoo! Inc. (Nasdaq:YHOO), a leading global Internet communications, commerce and media company, to be **featured** on Yahoo! Shopping (http://shopping.yahoo.com).

Recently ranked the No. 1 portal shopping destination by Neilsen//NetRatings (Aug. 2000), Yahoo! Shopping is utilizing imix...

...the option to make a customized music CD. The entire imix.com library of music, major artists and record label content, as well as additional **special** promotions, are being made available to consumers using Yahoo!. As part of the agreement, imix.com has fixed placement within the Music category of Yahoo! Shopping, featuring imix.com's CustomCD service. imix.com will also develop **special** promotions that will be **featured** in Yahoo! Shopping's Music category on an ongoing basis.

"The Yahoo! relationship also represents a continuation of our syndication strategy," Gould added. "Our goal...
...obtain personalized entertainment from imix.com.

"Yahoo! Shopping is dedicated to delivering the best products and services available to our large consumer audience, and the **type** of personalized entertainment experience that imix.com provides helps us fulfill that goal," said Rob Solomon, director of production, Yahoo! Shopping. "We are **happy** to work with imix.com and give consumers broad access to their innovative service."

Yahoo! Shopping is the only place consumers need to go to find, compare and buy almost anything online. Whether looking for personalized CDs, gifts for family or friends or the latest fashions, shoppers will find the **popular** merchants, brands and buying information they want on Yahoo!'s comprehensive Internet shopping destination. Consumers can shop for items from thousands of merchants in 20 retail categories, from trusted, brand name retailers. Yahoo! Shopping also has convenient **features**, such as Yahoo! Wallet and Express Checkout, that make online shopping fast and easy. Yahoo! Shopping is part of Yahoo!'s comprehensive suite of commerce...

...000 individual licensed tracks from more than 250 record labels. Customers who visit the Web site can search imix.com's extensive music library by **genre**, title, label, artist, or **mood**. imix.com also **offers** mix **suggestions** for holidays and **special** occasions. Additionally, there is a selection of secure digital downloads and free music found on the company's Web site (www.imix.com).

In conjunction...

20/3,K/8 (Item 8 from file: 20)
DIALOG(R)File 20: Dialog Global Reporter
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11597285 **(USE FORMAT 7 OR 9 FOR FULLTEXT)**
Angry Coffee Releases Music Network Search Engine

PR NEWSWIRE
June 21, 2000
Journal Code: WPRW **Language:** English **Record Type:** FULLTEXT
Word Count: 626
(USE FORMAT 7 OR 9 FOR FULLTEXT)

...download independent artists," said Co-Founder and CEO, Adam Powell. "It's clear that there's no way to halt the technological innovation that's **driving** products like Gnutella and Napster -- nor would we want to just because some of these companies have ethically questionable business plans. What we want to do is give **indie** artists a real shot at mixing into the mainstream."

Percolator is free, anonymous, much faster than Napster, and there is no application to download (it...

...point of view and has released this developmental version of Percolator to call attention to the fact that distributed digital music networks can better promote **indie** musicians. If you are a musician you can sign on to be an Angry Coffee Artist and see your name in lights, where the online...

...from other artists -- which is a bit like playing to an audience composed solely of the other bands on a bill," notes Luke Knowland, Interface **Specialist**. "If we can't stop people from pirating Bruce Springsteen, at least we can **feature** independent artists that Bruce fans might like along with his **music** in a **search** return."

About Angry Coffee:

As working independent musicians themselves, the founders of Angry Coffee have been putting their music online and making tutorials to help...

...links to additional resources. Angry Coffee has been growing ever since. Angry Coffee's Other Products And Services: -- Angry Coffee Artists -- Angry Coffee Artists are **featured** alongside all search returns for our music search engine, Percolator. Become a member and get "percolated" to the top. -- Fresh Ears -- See what's relevant to the online audio world on Angry Coffee's website. Experts speak weekly in AudioFile, or read **special Features**, or just check in to get some comic relief from the creator of Too Much Coffee Man at Bulker.

Tutorials -- Angry Coffee **features** a tutorial suite that provides clear and concise information on how to work with the latest useful online audio applications: -- Learn to play and encode...

...with mp3, the digital audio compression technology that exploded onto the Internet last year. -- Experience interactive music with Beatnik, a technology that brings high sound **quality**, tiny file sizes and true interactivity to Web audio. -- Work with Macromedia's Flash to add event-triggered sounds and animation to your Web site. -- Add audio and

video with Quicktime 4, the most **popular** online format for MIDI and video-oriented multimedia compositions. Angry Coffee http://www.angrycoffee.com .
/CONTACT: public relations, **Styles** Markus, 415-558-7795, or info@angrycoffee.com, or business and partnerships, Adam Powell, 415-558-7796, or adam@angrycoffee.com, or advertising, Matt Romano...

20/3,K/19 (Item 19 from file: 20)
DIALOG(R)File 20: Dialog Global Reporter
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03093555 **(USE FORMAT 7 OR 9 FOR FULLTEXT)**
DMX Enhances the Online Experience for Music Lovers With the Launch of Its Revamped Website; Unparalleled Digital Music Service Provider Now Has A Website to Match

BUSINESS WIRE
October 13, 1998 9:26
Journal Code: WBWE **Language:** English **Record Type:** FULLTEXT
Word Count: 1181
(USE FORMAT 7 OR 9 FOR FULLTEXT)

-
...by DMX's TCI Music sister company SonicNet--the authority in online music sites, presents a dynamic and entertaining experience with all new and improved **features** that will bring fans and first time visitors alike coming back for more.
DMX and SonicNet set out to demonstrate DMX's music know-how...
...announced initiatives with THE BOX, represents the first steps in the company's future convergence plans."
"DMX's website relaunch is the beginning of an **aggressive** campaign our company is taking to capitalize on consumer recognition of DMX's music expertise and reinforce our leadership position in the digital music industry...

...redesign and create our next generation website has allowed us to launch an online music site that is fun, informative and truly compelling to visitors."
Features of the new site:
-- Virtual DMX: This first-of-its-kind application allows browsers to listen to high-**quality** audio clips from each of DMX's more than 95 music formats available worldwide. Visitors can enjoy the Virtual DMX demonstration while simultaneously surfing the rest of the site, creating a unique multimedia experience.
-- Music Guide: The improved DMX Music Guide has an advanced interface and contains **detailed** information on each of the 13 DMX music **genres** as well as the more than 95 individual programs. Once a program is selected, the visitor may link to the Virtual DMX application and listen...

...required energy level and the target demographics, the user advances to the DMX Signature Sound screen with recommendations for a variety of DMX programs tailored **specifically** for their business which will assist them in building their brand image and achieving their marketing goals.

The **popular** "What's on DMX" **feature** where listeners access **detailed** title, track and artist information on the last five songs played on any DMX program is now titled "What's Playing Now" and has been expanded to allow visitors to access **detailed** artist or group information from an extensive database of more than 30,000 artists. Also improved from the previous site is a zip code database...

...name, title or other criteria. Also under construction is an enhancement to the "What's Playing Now" application which will allow visitors to hear live **samples** of the **selection** currently **playing** on any DMX program, link to the artist information database and then link to a partner site to purchase the CD. The site will continue...

...owned subsidiary of TCI Music, Inc., is a global leader in digital music, currently programming more than 95 unique programs of continuous, commercial-free, CD-**quality** music. The company markets and distributes its Digital Music Express(R) service on four continents serving more than 3.5 million homes and 55,000...

...entertainment network, operating sites on the World Wide Web including SonicNet, Addicted to Noise, Streamland and Cinemachine. SonicNet is widely recognized as the most acclaimed, **popular** and innovative music site on the Web. Receiving in excess of 5 million page views per month, it is the leader in providing breaking and...

20/3,K/20 (Item 20 from file: 20)
DIALOG(R)File 20: Dialog Global Reporter
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03007304

N2K's Music Boulevard to Offer 'My Music Boulevard' Where Customers Can Create Their Own Music Service

PR NEWSWIRE
October 05, 1998
Journal Code: WPRW **Language:** English **Record Type:** FULLTEXT
Word Count: 1060

-

...closely to the music they love based on their personal preferences. Developed in cooperation with Post Communications, a leading Internet services and technology firm that **specializes** in tailored Internet marketing solutions, and set to launch the week of October 12th, 'My Music Boulevard' will offer music fans a completely customizable interface. This will enable users to design their own personal email newsletter that will

feature album reviews, **feature** stories, advance notification of new album releases; exclusive deals, breaking music news alerts about imminent live events and Webcasts and more. This service allows N2K...

...our customers on an individualized basis. Our customers will be able to take advantage of all of Music Boulevard's rich content, information, entertainment and **special** offers without endless searching," said J. J. Rosen, president of the Music Boulevard Network. "Our experience over the past years has told us clearly that customers respond to **specific** information and content about the music they love. One of the key advantages of e-commerce is the ability to develop a continuous loop of...
...My Music Boulevard' so that now the fan gets to decide for themselves," said David Pakman, Vice-President Business and Product Development. Music is by **nature** personal and **emotional** and the promise of the Internet is in its interactivity and two-way communication. Regardless of where our customers may find Music Boulevard, whether a...

...or monthly basis and even elect to receive them in a graphic-rich, HTML format. These e-mails will contain sounds samples as well as **detailed** information about each artist mentioned. The news and editorial content in each newsletter will **feature** content compiled by Music Boulevard's critically acclaimed editorial staff headed by John Bitzer, editor-in-chief, the Music Boulevard Network. Music Boulevard was the...

...Web In Review. Recently named the Best Online Music Retailer by USA Today in a reader's poll, Music Boulevard allows shoppers to browse for **music** by **genre**, or **search** by album name, artist or song title. 'My Music Boulevard' enables the customer to create a completely customized service to connect even more closely to...

...of orders, gift certificates and gift shipping. Repeat shoppers earn credit toward free CDs with the Frequent Buyers Club. Music Boulevard recently debuted a new **Classical Search** that allows **music** fans to sift through the store's complex catalog of more than 45,000 **classical** CD and cassette titles in an intelligent and intuitive way. Several new store departments have recently been introduced at Music Boulevard including departments for **Blues**, Children's, **Indie Rock**, Electronica, and Gospel/Christian music. About N2K Inc. N2K Inc. is a leading online music entertainment company and the Internet's complete resource for music...

...the world's #1 online music store and the award-winning music channels: Rocktropolis (http://www.rocktropolis.com), Jazz Central Station (http://www.jazzcentralstation.com), **Classical** Insites (http://www.classicalinsites.com) and the Star Sites including Stones World (http://www.stonesworld.com) and the official sites for Leonard Bernstein (http://www...

...Wynton Marsalis (http://www.wyntonmarsalis.com). Music Boulevard (musicblvd.com) offers a choice of more than 300,000 music titles and over 350,000 sound **samples**. The Music Boulevard Network is the preferred or exclusive music partner for America Online (AOL Keyword: MB), AOL Japan, AOL Europe, Netscape, Excite, Disney.com...

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IV. Text Search Results from Dialog (Abstract dbs)

A. Abstract Databases -- Patent

File 347:JAPIO Dec 1976-2009/Nov(Updated 100228)
(c) 2010 JPO & JAPIO
File 350:Derwent WPIX 1963-2010/UD=201019
(c) 2010 Thomson Reuters

```
Set     Items   Description
S1       7260   (MUSIC? OR MELODY OR SONG OR SONGS OR SINGING OR
PERFORMANCE(5N)(MUSIC?
 OR BAND OR ORCHESTR?) OR ORCHESTRA? OR BANDS)(4N)(SEARCH? OR QUER? OR REQUEST? OR
 INQUIR? OR USER(2N)INPUT?)

S2       4830   (INTERFACE? OR SCREEN? ? OR MONITOR? ? OR COMPUTER? OR NETWORK ? OR
WEB?  OR ONLINE OR DATABASE? OR DATASYSTEM? OR PROCESSOR? OR ENGINE? ? OR GUI OR
DISPLAY? OR  CRT? ? OR CATHODE()RAY OR OUTPUT? OR WORKSTATION? OR KEYBOARD? OR PC
OR (KNOWLEDGE OR  DATA)()BASE?  )

S3       2321   ATTRIBUTE? OR FEATURE? OR QUALIT? OR CHARACTERISTIC? OR PARAMET? OR
TERMS  OR NATURE OR VECTOR? OR SPEC? OR DETAIL?

S4       1148   GENRE? OR TYPE? OR ROCK OR R(2W)B OR BLUES OR RHYTHM(2W)BLUES OR
STYLE? OR CLASSICAL OR MODERN OR PROG OR PROGRESSIVE OR METAL OR HEAVY OR
INSTRUMENTALS OR  POPULAR OR ALTERNATIVE(2W)(MUSIC? OR ROCK) OR INDY OR INDIE OR
DRIVEN OR POP OR  CLASSIFICATION? OR TAXONOM? OR TYPOLOGY

S5        198   EMOTION? OR MOOD? OR HAPPY OR SAD OR DARK OR RHYTHM(2N)TYPE OR
INTENSE OR LOUD OR MELLOW OR RAUCOUS OR SAD OR AGGRESSIVE OR UPBEAT OR DOWNCAST OR
ROWD? OR  ROMANTIC OR SWEET OR DRIVING OR DANCEABLE

S6        460   (SELECTION? OR SAMPLE? ? OR EXAMPLE? OR PROMOTIONAL OR SUGGESTION?
OR EXCERPT? OR SIMILAR OR ALTERNAT? OR RELATED OR OTHER OR SUPPLEMENT? OR LIKE OR
COMMON OR  SELECT) (3N) (OFFER? OR PRESENT? OR DISPLAY? OR GUI ? ? OR BRING?()UP OR
INTERFACE? OR  SPEAKER? ? OR HEADPHONE? OR HEAD()PHONE? OR EAR()PHONE? OR EARPHONE?
OR PLAY?)

S7         67   S3 AND S4 AND S5
S8         16   S7 AND (S6 OR SAMPLE?)
S9         14   S8 FROM 347,350
S10         2   S8 NOT S9
S11      4830   S2 OR S3 OR S5
S12      4072   S11(S)S1
S13       259   S12(S)S6
S14       234   S13 FROM 347,350
```

```
S15          89   S14 NOT AY>2000
S16           5   S15 AND SAMPLE?
S17           1   S9 NOT AY>2000
S18           6   S17 OR S16
S19          25   S13 NOT S14
S20          25   S19 OR S10
S21           3   S20 NOT PY>2000
S22           6   IDPAT S18 (sorted in duplicate/non-duplicate order)
S23           6   IDPAT S18 (primary/non-duplicate records only)
```

23/3,K/1 (Item 1 from file: 350)
DIALOG(R)File 350: Derwent WPIX
(c) 2010 Thomson Reuters. All rights reserved.

0013900427 *Drawing available*
WPI Acc no: 2004-079813/200408
XRPX Acc No: N2004-063750
Query creation method for use in musical content search, involves receiving selection criteria identifying portion of structural representation of musical content and creating query profile from identified portion
Patent Assignee: INT BUSINESS MACHINES CORP (IBMC)
Inventor: KRAFT R; LU Q; TENG S

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
US 6674452	B1	20040106	US 2000543218	A	20000405	200408	B

Priority Applications (no., kind, date): US 2000543218 A 20000405

Patent Details					
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**
US 6674452	B1	EN	17	10	

Original Publication Data by AuthorityArgentina**Publication No.** ...**Original Abstracts:**existing piece of music, or some components thereof, as query arguments, and lets the music search engine find music that is similar to the given **sample** by certain similarity **measurement. >...Claims:of the first musical piece in the form of a component graph that displays parts and measure components of the first musical piece;(d) receiving selection criteria identifying at least a portion of the structural representation of the first musical piece; and(e) creating a query profile from the identified portion of the structural representation of the first musical piece.**

Dialog eLink: Order File History

23/3,K/2 (Item 2 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0012950404 *Drawing available*
WPI Acc no: 2003-027267/200302
System and method for searching for music data based on contents
Patent Assignee: ELECTRONICS&TELECOM RES INST (ETRI)
Inventor: CHUN Y S; KIM H N; MUN B R; SON S U

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
KR 2002053979	A	20020706	KR 200082255	A	20001226	200302	B

Priority Applications (no., kind, date): KR 200082255 A 20001226

Patent Details					
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**
KR 2002053979	A	KO	1	10	

Alerting Abstract ...comprises a client web server(10), a contents based music information retrieval server(20), a web server(21), a CGI(Common Gateway Interface, 22), a **melody** transcription module(23), a **search** criteria module(24), an HTML formatter(25), a music retrieval module(26), a **music search** module(27), and a **music database** (28). The music **database**(28) stores or manages the music data. The **web** server(21) and the CGI(22) receive audio **samples** and search instructions from the client **web** server(10) and offer the search result to the client **web** server(10). Also, the **web** server(21) receives music retrieval instructions from the client **web** server(10) and offers the retrieval result to the client **web** server(10). The melody transcription module(23) analyzes the audio **sample** transmitted via the CGI(22), and generates the corresponding **musical** note. The **search** criteria module(24) analyzes the search instructions and sets **search** criteria and conditions. The **music** retrieval module(27) retrieves from the music **database** (28) the music data including the musical note, generated by the melody transcription module(23), according to the **search** criteria and conditions. The **music search** module(26) **searches** the **music database** for a music title, and transmits the music title to the **web** server(21) via the CGI(22).

Dialog eLink: Order File History

23/3,K/3 (Item 3 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0010902193 *Drawing available*
WPI Acc no: 2001-523052/200158
Related WPI Acc No: 2000-224113; 2001-603816; 2002-338007; 2002-469860; 2003-016027; 2005-178917; 2005-743509; 2006-086186; 2006-314711; 2006-328117; 2006-723662
XRPX Acc No: N2002-062036

Unique identification method for digital content on digital content player, by receiving first, second and third identifiers, and producing fourth unique identifier based on mathematical combination of identifiers

Patent Assignee: IBM CORP (IBMC); INT BUSINESS MACHINES CORP (IBMC); WISTRON CORP (WIST-N)
Inventor: DORACK J J; DORAK J J

Patent Family (12 patents, 30 countries)

Patent Number	Kind	Date	Application Number	Kind	Date	Update	Type
CN 1289100	A	20010328	CN 2000127012	A	20000914	200158	B
EP 1085443	A2	20010321	EP 2000308024	A	20000914	200212	ETAB
CA 2316762	A1	20010317	CA 2316762	A	20000817	200159	E
JP 2001160003	A	20010612	JP 2000279877	A	20000914	200159	E
KR 2001050381	A	20010615	KR 200053161	A	20000907	200171	E
US 6389403	B1	20020514	US 1998133519	A	19980813	200239	E
			US 1998177096	A	19981022		
			US 1999397419	A	19990917		
KR 444695	B	20040818	KR 200053161	A	20000907	200481	E
CA 2316762	C	20070403	CA 2316762	A	20000817	200726	E
CN 100345157	C	20071024				200830	E
EP 1085443	B1	20080827	EP 2000308024	A	20000914	200858	E
DE 60040041	E	20081009	DE 60040041	A	20000914	200868	E
			EP 2000308024	A	20000914		
JP 4347508	B2	20091021	JP 2000279877	A	20000914	200970	E

Priority Applications (no., kind, date): US 1998133519 A 19980813; US 1998177096 A 19981022; US 1999397419 A 19990917

Regional Designated States,Original	AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI

Patent Details

Patent Number	Kind	Lan	Pgs	Draw	Filing Notes	
US 6389403	B1	EN		18	C-I-P of application	US 1998133519
CN 1289100	A	ZH			C-I-P of application	US 1998177096
CA 2316762	A1	EN			C-I-P of patent	US 6226618
JP 2001160003	A	JA	82		Previously issued patent	KR 2001050381
KR 444695	B	KO				
EP 1085443	A2	EN	97	18		
CA 2316762	C	EN				

EP 1085443	B1	EN				
Regional Designated States,Original	AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE					
DE 60040041	E	DE			Application	EP 2000308024
					Based on OPI patent	EP 1085443
JP 4347508	B2	JA	107		Previously issued patent	JP 2001160003

Original Publication Data by AuthorityArgentina**Publication No.** ...**Original Abstracts:**object of the conventional store, i.e., a non-electron, and non-online uses product sales promotion, product sales, a product **sample**, a generous returned-goods plan, and other sales promotion programs, Itself is differentiated from a competitor.However, in the on-line world where a content...specific encoding algorithm and specific bit rate.When the rate coefficient calculated before is not memorize|stored, only the time of predetermined length encodes the **sample** of the content 113.The predetermined time period of preferable embodiment is 2 to 3 seconds.The ratio of an encoding of this predetermined time...invention, and the meaning.The data (For example, the genre relevant to the list|wrist, this artist, or product of the album in which the **sample** clip by this artist, this artist's passage|experience, and this recording are included in the case of a music) which the content provider 101... ...an end user, The content provider 101 can identify Type (For example, the genre relevant to the list|wrist of the album in which the **sample** clip by this artist, this artist's passage|experience, and this recording are included in a musical example, and this artist) of the sales promotion... ...end user apparatus 109 requires, the data field which can be supplied to the end user apparatus 109 as option, And the group of the **sample** of the data field which makes the electronic digital content store 103 object which accelerates|stimulates an artist, an album, or a single sale is... AC3, ATRAC (trademark)) and a compression level.In order to achieve compression of a higher level, before passing a compression algorithm, data are usually re-**sampled** with a low sampling rate.In order to enable efficient compression rather than there are few loss|disappearances of fidelity, or in order to prevent... ...than the downloadable audio file for sale also has the clip by which the LBR encoding was carried out, in order to be able to **sample** music via the low bit-rate (LBR) streaming protocol.This LBR encoding is also the responsibility for the content processing tool 155.This clip is...audio file produced during the audio processing regarding various quality levels of perfect music packs to separate content SC630.The audio file produced for the **sample** clip is passed as a metadata file, and is included in metadata SC620.F. Last quality assurance toolThe last quality assurance tool gives a user...content store 103, and the end user web browser 191 of the end user apparatus 109.The preview of the digital content clip of a **sample** is included in this.As for a digital content clip, packaging is not carried out to SC, However, Instead, the web service of the electronic...wrist object- Music list display container, othersA container, others- Player window container- Audio control container- Metadata control container- Metadata display container- Tool bar container object- **Sample** button- Download button- Purchasing button- Recording button- Player name object- Label / provider / store advertisement object- Label / provider / store URL button- Artist URL button, others3. Copy... ...on actual use, a user's identification, and the frequency|count by which content 113 was performed.By the measurement of actual use, this system **samples** only limited numbers, such as the Nielsen Index system or a telephone poll of a television, of users at 1:00, It becomes a fact...list is preserve| saved to the digital content library 196.- Deletion of music- The music selected now is deleted from a reproduction list.- Addition of **music**- It calls in **music search** mode for selection of the music

which a digital content librarian adds to a reproduction list.For **details**, please also refer a younger digital content librarian's item.- Setting of music information- The information regarding the music selected within the reproduction list is **displayed**, and the change with respect to the information is enabled.The information regarding the music which this information was stored in the reproduction list and stored in the digital content library 196 is not changed.The following items can be changed.- Title of music **displayed**- Memo of end user regarding music- Lead-in delay at the time of music reproduction|regeneration- Followone|on delay after music reproduction|regeneration- Starting point... ...of reproduction|regeneration- Ending point in music at the time of reproduction|regeneration- Weighting for random modes- volume control and others of this musicReproduction-list **attribute** setting: The **attribute** of this reproduction list is **displayed** and the change with respect to it is enabled.The following **attributes** can be set.- Title of reproduction list- Mode of reproduction list (random, sequential, in addition to this)- Repeat mode (at the time of completion|finish 1-time reproduction|regeneration, restart, in addition to this)- memo of end user regarding this reproduction listLibrarian (Corresponding|compatible on **Screen** 1601 of an end user **interface**) and a digital content librarian window are opened.For **details**, please also refer a younger digital content librarian's item.A reproduction|regeneration of musicBy either of selecting the music which is depended on calling... ...digital content librarian, When the music for a reproduction|regeneration is ready, the option of an end user is as follows (It respond|corresponds to **Screen** 1601 of an end user **interface**.).- Reproduction|regeneration- Pause- Stop- It skips back.- It skips to front.- Volume control- Track|truck position adjusting- Lyric **display**- Credit **display**- CD cover **display**- Artist picture **display**- Presenting of track|truck information- **Display** of **other** metadata- **Website** visit- Reproduction list- Librarian, othersthe inside of implicitness when a digital content librarian digital content librarian selects music or a reproduction list -- calling (refer the... ...identifier intrinsic|native to the content processed.Transaction ID535 are some transaction data 642 in content ID1802 within the transaction SC640 produced with the transaction **processor** module 175, as demonstrated above in the top.Transaction ID535 is an identifier intrinsic|native to each of the whole purchasing transaction from the end ...system which identifies use of digital content on user apparatus, Comprising:They are several content sites which distribute digital content to a user on a **computer**-readable medium, Comprising:The said digital content is several content sites containing the unique content identifier link|related with it, and several cyberstores which give...said digital contentThe digital content player which contains these further and which identifies uniquely the digital content as described in said (10).(15) It is **computer**-readable medium including program command which identifies digital content uniquely on digital content player, Comprising:The program command which receives the 1st identifier which identifies... ...The program command which receives the 3rd identifier which identifies uniquely the item in the transaction which received the said digital content by it, The **computer**-readable medium which includes the program command which makes a 4th unique identifier based on the mathematical combination of the above-mentioned 1st identifier, the above-mentioned 2nd identifier, and the above-mentioned 3rd identifier.(16) The **computer**-readable medium as described in said (15) including that the said program command to make makes a 4th unique identifier based on connection of the above-mentioned 1st identifier, the above-mentioned 2nd identifier, and the above-mentioned 3rd identifier.(17) The **computer**-readable medium as described in said (15) in which the program command which receives the above-mentioned 2nd identifier includes receiving the identifier unique from... ...store which sells the said digital content.(18) Program command which receives the above-mentioned 3rd identifier from store which sells said digital content, The **computer**-readable medium as described in said (17) including receiving the unique identifier from which the said digital content identifies uniquely the transaction received by it.(19) Program command which link|relates above-mentioned 4th unique identifier with said digital content

including service condition, The **computer**-readable medium as described in said (15) which includes further the program command which re-evaluates the said service condition by carrying out indexing of the above-mentioned 4th unique identifier before reproduce|regenerating the said digital content.(20) The **computer**-readable medium as described in said (15) which includes making the above-mentioned 4th unique identifier in a tamper-proof environment in order that the... ...8 and which shows the outline|summary of content distribution and license grant control.It is a figure by this invention which shows the user **interface** of the **example** of the workflow manager tool of FIG. 1 thru|or 4.They are the main tools of the workflow manager corresponding to the user **interface** of FIG. 10 by this invention, a component, and a block diagram of a processing.It is the main tools of the electronic digital content... ...of the automatic metadata acquisition tool of FIG. 11 by this invention.It is a flowchart of the method of setting automatically the pre-processing **parameter** and compression **parameter** of the pre-processing of FIG. 11 by this invention, and a compression utility.It is a figure by this invention which downloads content to a local library like FIG. 18 and FIG. 19 and which shows the **example** of the user **interface screen** of a player application.It is a block diagram which shows the components and processings with a main player application by this invention in which **interface screen** of the **example** of the **player** application of FIG. 18 and FIG. 19.It is a flowchart of alternative embodiment for pick... ... acquisition processing804 Manual metadata input processing805 Service-condition processing806 Monitoring publication|presentation processing807 Metadata SC preparation processing808 Watermarking processing809 Pre-processing and compression processing810 Content **quality** control processing811 Encryption processing812 Content SC preparation processing813 Last **quality** assurance processing814 Content distributed processing...

Dialog eLink: Order File History

23/3,K/4 (Item 4 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0009790451 *Drawing available*
WPI Acc no: 2000-079300/200007
Display item input controller for user interface type music selection device of karaoke performance apparatus in karaoke hall - allows selection input of display item, when displayed finger image of user overlaps with display area of display item
Patent Assignee: DAIICHI KOSHO KK (DIIK)
Inventor: OSHIOKA D

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
JP 11327571	A	19991126	JP 1998125058	A	19980507	200007	B

Priority Applications (no., kind, date): JP 1998125058 A 19980507

JP 11327571	A Patent Details			2	
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**

Display item input controller for user interface type music selection device of karaoke performance apparatus in karaoke hall... ...allows selection input of display item, when displayed finger image of user overlaps with display area of display item Alerting Abstract ...NOVELTY - Characteristic pattern of finger of user, is extracted from corresponding picked up image, and it is compared with a **sample** pattern stored beforehand. When matching between two patterns is judged, corresponding finger image is displayed along with corresponding input display item. When the displayed finger...

Dialog eLink: Order File History

23/3,K/5 (Item 5 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0008608871 *Drawing available*
WPI Acc no: 1998-144865/199813
XRPX Acc No: N1998-114614
Wave-table music synthesis computer system - generates second request for one or more wave-table data samples to I-O bus interface that is high priority fill request
Patent Assignee: ADVANCED MICRO DEVICES INC (ADMI)
Inventor: GULICK D E

Patent Family (1 patents, 1 countries)							
Patent Number	**Kind**	**Date**	**Application Number**	**Kind**	**Date**	**Update**	**Type**
US 5717154	A	19980210	US 1996622472	A	19960325	199813	B

Priority Applications (no., kind, date): US 1996622472 A 19960325

Patent Details					
Patent Number	**Kind**	**Lan**	**Pgs**	**Draw**	**Filing Notes**
US 5717154	A	EN	18	10	

...**generates second request for one or more wave-table data samples to I-O bus interface that is high priority fill request Alerting Abstract** ...The buffer manager generates a first request for one or more wave-table data **samples** to the I/O bus interface. The first request is a normal fill request and the I/O bus interface generates a normal priority I... ...I/O bus arbiter in response to the normal fill request. The buffer manager generates a second request for one or more wave-table data **samples** to the I/O bus interface that is a high priority fill request... **Title Terms** .../Index Terms/Additional Words: **SAMPLE**; **Class Codes** Original Publication Data by AuthorityArgentina**Publication No.** ...**Original Abstracts:**a buffer manager coupled to the I/O bus interface, the synthesizer, and the plurality of buffers. The synthesizer generates a request for wavetable data **samples**. The buffer manager **determines** if the

samples are in the **buffers**. If the **samples** are in the **buffers** but one of the buffers has become a predetermined amount empty, the buffer manager generates a normal fill request to the I/O bus interface... ... bus interface generates a normal priority I/O bus request to the I/O bus arbiter in response to the normal fill request. If the **samples** are not in **the** buffers, the buffer manager generates a high priority fill request to the I/O bus interface. The I/O bus interface generates a high priority... ... response to the high priority fill request. When the I/O bus arbiter grants bus mastership to the I/O bus interface, the buffer manager **fetches** the **samples** from the system **memory**. The synthesizer generates sounds in response to the wavetable data **samples. >Claims:Claim 13. A method of performing wavetable music synthesis in a system comprising a system memory storing wavetable data samples, an I/O bus, and I/O bus arbiter and a system audio device, said system audio device having an I/O bus interface coupled to said I/O bus, and a synthesizer, comprising:said synthesizer generating a first fill request to said I/O bus interface for a wavetable data sample, wherein said first fill request is a normal fill request;said I/O bus interface generating a normal priority I/O bus request to said I/O bus arbiter in response to said normal priority fill request;said synthesizer generating a second fill request to said I/O bus interface for a wavetable data sample, wherein said second fill request is a high priority fill request;said I/O bus interface generating a high priority I/O bus request to said I/O bus arbiter in response to said high...**

Dialog eLink: Order File History

23/3,K/6 (Item 6 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0007759430 *Drawing available*
WPI Acc no: 1996-384256/199638
XRPX Acc No: N1996-323857
Interactive multimedia system with music composing function - has interface with application program for running multimedia presentation, and to which parameters are supplied for designing desired composition type etc.
Patent Assignee: BLUE RIBBON SOUNDWORKS LTD (BLUE-N); MICROSOFT CORP (MICR-N)
Inventor: FAY C T

Patent Family (2 patents, 18 countries)

Patent Number	Kind	Date	Application Number	Kind	Date	Update	Type
WO 1996024422	A1	19960815	WO 1996US1517	A	19960205	199638	B
US 5753843	A	19980519	US 1995384668	A	19950206	199827	E

Priority Applications (no., kind, date): US 1995384668 A 19950206

National Designated States,Original	JP	Patent Details					
Regional Designated States,Original	AT BE CH DE DK ES FR GB GR IE IT LU MC NL PT SE						
Patent Number	**Kind**	**Lan**	**Pg**	**Dwg**	**Filing Notes**		
WO 1996024422	A1	EN	54	20			

...**has interface with application program for running multimedia presentation, and to which parameters are supplied for designing desired composition type etc. Alerting Abstract** ...The system for composing music in response to a user's interface with a multimedia device has an application program interface for receiving **parameters** for identifying music related to the user's interaction with the multimedia presentation. A composing device derives a musical section corresp. to the **parameters** so that a user perceives the performance of the musical section to be related to the user's interaction with the multimedia device... **Title Terms** .../Index Terms/Additional Words: **PARAMETER**; ... ...**TYPE Class Codes** Original Publication Data by AuthorityArgentina**Publication No.** ...**Original Abstracts:**system includes a composition engine, performance engine, and arbitrator. The arbitrator provides an interface with an application program running a multimedia presentation. The arbitrator receives **parameters** from the application **program** indicative of a user's interaction and the **type** of music the **application** program requests in response to the interaction. The **parameters** are passed to **the** composition engine which composes a musical section having a chord progression and other data therein. The musical section and a **style** provided by the **arbitrator** are used by the performance engine to generate music sequence data for **driving** a musical instrument. **The** performance of the musical sequence data by the musical instrument occurs substantially contemporaneously with the user's interaction which caused the musical section composition. Because... ... composition engine (14), performance engine (16), and arbitrator (12). The arbitrator provides an interface with an application program running a multimedia presentation. The arbitrator receives **parameters** from the application program indicative of a user**'s** interaction and the **type** of music the application program requests in response **to** the interaction. The **parameters** are passed to the composition engine (14) which **composes** a musical section having a chord progression and other data therein. The musical section and a **style** provided by the arbitrator are used by the **performance** engine (16) to generate music sequence data for **driving** a musical instrument.The performance of the musical **sequence** data by the musical instrument occurs substantially contemporaneously with the user's interaction which caused the musical section composition. Because the composition engine (14) uses... **Claims:**A system for composing music in response to a user's interaction with a multimedia presentation comprising:an application program interface for receiving **parameters** identifying a **style**, **a** shape, and **a** personality for music that conform to said user's interaction with said multimedia presentation; anda composition engine for composing a musical section corresponding to said **parameters** so that a user perceives **the** performance of the musical section to be related to said user's interaction **with** said multimedia **presentation.>**

B. Abstract Databases – NON-PATENT

File 35:Dissertation Abs Online 1861-2010/Apr
(c) 2010 ProQuest Info&Learning
File 583:Gale Group Globalbase(TM) 1986-2002/Dec 13
(c) 2002 Gale/Cengage
File 65:Inside Conferences 1993-2010/Jun 04
(c) 2010 BLDSC all rts. reserv.
File 2:INSPEC 1898-2010/May W3
(c) 2010 The IET
File 474:New York Times Abs 1969-2010/Jun 04
(c) 2010 The New York Times
File 475:Wall Street Journal Abs 1973-2010/Jun 04
(c) 2010 The New York Times
File 99:Wilson Appl. Sci & Tech Abs 1983-2010/Mar
(c) 2010 The HW Wilson Co.
File 256:TecTrends 1982-2010/May W5
(c) 2010 Info.Sources Inc. All rights res.
File 8:Ei Compendex(R) 1884-2010/May W4
(c) 2010 Elsevier Eng. Info. Inc.
File 6:NTIS 1964-2010/Jun W1
(c) 2010 NTIS, Intl Cpyrght All Rights Res
File 34:SciSearch(R) Cited Ref Sci 1990-2010/May W5
(c) 2010 The Thomson Corp
File 434:SciSearch(R) Cited Ref Sci 1974-1989/Dec
(c) 2006 The Thomson Corp
File 7:Social SciSearch(R) 1972-2010/May W5
(c) 2010 The Thomson Corp

```
Set     Items   Description
S1       7260   (MUSIC? OR MELODY OR SONG OR SONGS OR SINGING OR
PERFORMANCE(5N)(MUSIC?  OR BAND OR ORCHESTR?) OR ORCHESTRA? OR BANDS)(4N)(SEARCH?
OR QUER? OR REQUEST? OR  INQUIR? OR USER(2N)INPUT?)

S2       4830   (INTERFACE? OR SCREEN? ? OR MONITOR? ? OR COMPUTER? OR NETWORK ? OR
WEB? OR ONLINE OR DATABASE? OR DATASYSTEM? OR PROCESSOR? OR ENGINE? ? OR GUI OR
DISPLAY? OR  CRT? ? OR CATHODE()RAY OR OUTPUT? OR WORKSTATION? OR KEYBOARD? OR PC
OR (KNOWLEDGE OR  DATA)()BASE?  )

S3       2321   ATTRIBUTE? OR FEATURE? OR QUALIT? OR CHARACTERISTIC? OR PARAMET? OR
TERMS  OR NATURE OR VECTOR? OR SPEC? OR DETAIL?
```

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S4       1148   GENRE? OR TYPE? OR ROCK OR R(2W)B OR BLUES OR RHYTHM(2W)BLUES OR
STYLE? OR CLASSICAL OR MODERN OR PROG OR PROGRESSIVE OR METAL OR HEAVY OR
INSTRUMENTALS OR  POPULAR OR ALTERNATIVE(2W)(MUSIC? OR ROCK) OR INDY OR INDIE OR
DRIVEN OR POP OR CLASSIFICATION? OR TAXONOM? OR TYPOLOGY

S5        198   EMOTION? OR MOOD? OR HAPPY OR SAD OR DARK OR RHYTHM(2N)TYPE OR
INTENSE OR LOUD OR MELLOW OR RAUCOUS OR SAD OR AGGRESSIVE OR UPBEAT OR DOWNCAST OR
ROWD? OR  ROMANTIC OR SWEET OR DRIVING OR DANCEABLE

S6        460   (SELECTION? OR SAMPLE? ? OR EXAMPLE? OR PROMOTIONAL OR SUGGESTION?
OR EXCERPT? OR SIMILAR OR ALTERNAT? OR RELATED OR OTHER OR SUPPLEMENT? OR LIKE OR
COMMON OR  SELECT) (3N) (OFFER? OR PRESENT? OR DISPLAY? OR GUI ? ? OR BRING?()UP OR
INTERFACE? OR  SPEAKER? ? OR HEADPHONE? OR HEAD()PHONE? OR EAR()PHONE? OR EARPHONE?
OR PLAY?)

S7         67   S3 AND S4 AND S5
S8         16   S7 AND (S6 OR SAMPLE?)
S9         14   S8 FROM 347,350
S10         2   S8 NOT S9
S11      4830   S2 OR S3 OR S5
S12      4072   S11(S)S1
S13       259   S12(S)S6
S14       234   S13 FROM 347,350
S15        89   S14 NOT AY>2000
S16         5   S15 AND SAMPLE?
S17         1   S9 NOT AY>2000
S18         6   S17 OR S16
S19        25   S13 NOT S14
S20        25   S19 OR S10
S21         3   S20 NOT PY>2000
S22         6   IDPAT S18 (sorted in duplicate/non-duplicate order)
S23     6  IDPAT S18 (primary/non-duplicate records only)
```

21/5,K/1 (Item 1 from file: 474)
DIALOG(R)File 474: New York Times Abs
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07673611 **NYT Sequence Number:** 044830990131
SUNSCREEN SERENADE
New York Times , Col. 3 , Pg. 11 , Sec. 6
Sunday January 31 1999
Document Type: Newspaper **Journal Code:** NYT **Language:** English **Record Type:** Abstract

Abstract:
Mock college graduation speech written in 1997 by Chicago Tribune columnist Mary Schmich, which turned into 'feel-good' anthem of Internet set after being posted on World Wide **Web**, and was then misattributed to novelist Kurt Vonnegut, was turned into a song by Australian film director Baz Luhrmann; disk was released in United States last spring, but tune went nowhere, largely because it took 7 minutes and 4 seconds to **play**; KNRK-FM, **alternative** station in Portland, Ore, has edited out extraneous vocal riff and started playing it in 4:30, and it has

become station's most **requested song**; drawing (S)

Special Features: Drawing
Company Names: KNRK-FM (Portland, Ore)
Descriptors: Music; Recordings (Audio); Internet and World Wide Web; Colleges and Universities; Music
Personal Names: Schmich, Mary; Vonnegut, Kurt; Luhrmann, Baz

Abstract:
...speech written in 1997 by Chicago Tribune columnist Mary Schmich, which turned into 'feel-good' anthem of Internet set after being posted on World Wide **Web**, and was then misattributed to novelist Kurt Vonnegut, was turned into a song by Australian film director Baz Luhrmann; disk was released in United States last spring, but tune went nowhere, largely because it took 7 minutes and 4 seconds to **play**; KNRK-FM, **alternative** station in Portland, Ore, has edited out extraneous vocal riff and started playing it in 4:30, and it has become station's most **requested song**; drawing (S)

V. Additional Resources Searched

No additional results of relevance found in the additional databases identified in the coverpage correspondence.